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DISPUTES AMONG EXPERTS

DISPUTES AMONG EXPERTS:
A SOCIOLOGICAL CASE STUDY OF
THE DEBATE OVER BIOLOGY
IN THE MACKENZIE VALLEY PIPELINE INQUIRY

By

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ABSTRACT

This work is a sociological case study of the disputes among expert biologists in the Mackenzie Valley Pipeline Inquiry. I argue that the disputes among experts are structured by the interest groups who sponsored expert testimony. Interest groups varied in their resources, organizational structure, interaction experiences, and basic defensive or critical argumentative stance. This variability is shown to be related to the cohesiveness of expert arguments across seven major debating points.

Open-ended interviews form the basis of most of the analysis. Since the populations are small, extensive quotations from the responses of participants are used at many points. The analysis is qualitative at many crucial points. The interviews are supplemented by an analysis of hearing transcripts, supporting material presented at the Inquiry, and published materials relating to the Inquiry.

The argument is constructed using an image of all action, including scientific reasoning, as interpretive action. Although a social product, action is considered to be a complex interpretive process. The importance of this image of action is developed in the assessment of the influence of various scientific and non-scientific issues to the opinions of scientists as experts. I treat statements by participants as part of arguments which,

I suggest, are unclear as to their motivational implications.

Within this framework, I consider the importance of interest groups for the structuring of expert arguments. I argue that the major industrial proponent was able to present an extremely cohesive set of expert arguments because of a variety of factors including their greater resources, their longer time to prepare a case, and their experience of having to defend a position. In contrast, critics, with their relatively meager resources, shortage of time, and position of critic, presented a far less cohesive set of expert arguments. This lack of a parallel structure in arguments runs counter to the dominant image, in the literature, of a more clearly polarized debate in conflicts among experts.

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CHAPTER 1

INTRODUCTION, THEORY AND METHOD

I Introduction

This is a sociological study of the debates among biologists in the Mackenzie Valley Pipeline Inquiry. It is not an attempt to evaluate who was right or wrong in the debates, and it is not a consideration of how well the Mackenzie Valley Pipeline Inquiry did its job. My sole purpose in this study is to gain some understanding of selected sociological dimensions of the Inquiry debates in biology among scientists.

I begin this analysis with a consideration of the social organization of scientists within the Inquiry. This starting point arises out of the sociological imperative that the analysis of any action must commence with a consideration of its social or group context. The context in this case was a public inquiry where a variety of interest groups presented expert evidence in support of their points of view. I explore the experiences of scientists with their interest group sponsors, with allied and opposed interest groups, and with the Commission itself. I reason that these patterns of conflict and interaction are important to an understanding of the opinion statements of scientists. I analyze, using this sociological base, scientists' assessments of the impact of pipeline development upon the biological environment.

The disputes among experts are then discussed in some detail over seven major debating issues related to the assessment of the effects of pipeline development. This includes an examination of "non-scientific" issues such as the desirability of northern development and the environmental responsibility of industry to the "scientific" issues of the relative vulnerability of arctic ecosystems and species to disturbance, and the adequacy of knowledge for prediction. In this analysis I attempt to assess the relative importance of each of these issues to the reasoning of experts.

Many sociological research problems, associated with such phenomena as social class, have a broad range of research sites. In contrast, disputes among experts occur around public policy issues. That is, the behaviour in which I am interested, occurs in a particular social context. The beginning point, therefore, for an analysis of this phenomenon is a case study which attempts to come to terms with this social situation.

This case study has developed within the context of a body of literature dealing with various dimensions of the scientist as expert. I have formed this study theoretically and methodologically in response to this literature. This chapter starts with an outline of this literature and continues with the elaboration of the theoretical and methodological structure of the study.

II The End of Ideology and Scientific Expertise

Two writers, Bell and Lane, have become identified with an "end of ideology" position as it relates to scientific expertise. These writers accentuate the administrative use of scientific expertise and argue that the growth of science infringes upon the political domain. In their view, science as rational action displaces irrational political action.

Daniel Bell concentrates his analysis on the development of "intellectual technology" (1976.p. 29) in modern society. For Bell this is most clearly exemplified by systems analysis, quantitative indicators, and the use of computers. This intellectual technology displaces the use of intuitive judgement by providing the objective means for the realization of various valued ends. In this way Bell advocates a cleavage between fact and value leaving intellectual technologies free of any polemical taint.

> Technical decision-making, in fact, can be viewed as the diametrical opposite of ideology: the one calculating and instrumental, the other emotional and expressive.
> (Bell 1976 p. 34)

This position implies the decline of political action in certain areas for if intellectual technology is displacing irrational ideological reasoning there is therefore a decline of political lobbying and influence in relation to those areas where this technology is applied.

These considerations are part of Bell's general argument about what he terms the post-industrial society (see Kuman 1978). Bell argues that modern society is developing into a post-industrial stage which is characterized by intellectual technology as a productive force and the dominance of scientific occupational groups.

> ... the scientific estate - its ethos and its organization - is the monad that contains within itself the imago of the future society. (Bell 1976, p. 378)

Science is for Bell an autonomous activity carried on by a community organized around what he terms the "ethos of science" which he labels as non-ideological.

> It has no ideology, in that it has no postulated set of formal beliefs, but it has an ethos which implicitly preserves rules of conduct. (Bell 1976, p. 380)

Bell draws his conception of this ethos from Merton (Merton 1968 pp. 591-615). There are four main components to this ethos: universalism, communalism, disinterestedness, and organized skepticism. Universalism indicates that careers within science are open on the basis of talent and that knowledge claims are evaluated on the basis of objective criteria and not on the basis of the personal or social attributes of an individual scientist. Communalism is the principle of collective ownership of intellectual property. The output of a particular scientist does not belong to an individual, and correspondingly individuals do not withhold information. Disinterestedness is a correlate of the adherence to objective criteria and the collective nature of scientific knowledge and procedures. Scientists must adhere to the dictates of their community and not to their particular interests. As evidence for this Bell refers to "the virtual absence of fraud in the annals of science" (Bell 1976,p. 382). Finally organized skepticism is "detached scrutiny" where all ideas are subject to impartial test.

> Scientific knowledge is not ideology (though it may be distorted for such purposes) but a public explanation subject to renewed tests of verification. (Bell 1976,p. 383)

Bell places the implications this ethos has for the behaviour of scientists in public life in propositional form:

> Science itself is ruled by an ethos which is different from the ethos of other major social groups (e.g. business, the military), and this ethos will predispose scientists to act in a different fashion, politically, from other groups.
> (Bell 1976 p. 359)

Bell's argument can be summarized as follows. Science is an activity which is characterized by rational objective pursuit. The use of scientific intellectual technology displaces irrational ideology. In addition, science is the product of the ethos of an autonomous community. This ethos of science will influence scientists' behaviour in political situations in the direction of objectivity and rationality.

Lane parallels Bell in his statements concerning the implications of the entrance of scientists in public debates and the growth of knowledge in modern society. Knowledge is for Lane encroaching on the arena of politics:

> If one thinks of the domain of "pure politics" where decisions are determined by calculations of influence, power, or electoral advantage, and a domain of "pure knowledge" where decisions are determined by calculations of how to implement agreed-upon values with rationality and efficiency, it appears to me that the political domain is shrinking and the knowledge domain is growing, in terms of criteria for decisions, kinds of counsel sought, evidence adduced, and nature of the "rationality" employed.
> (Lane 1966,p. 657)

Lane accentuates the quantitative growth of science and states that this growth impinges on ideology which he states is dependent on uncertainty.

> Since knowledge and ideology serve somewhat as functional equivalents in orienting a person toward the problems he must face and the policies he must select, the growth of the domain of knowledge causes it to impinge on the domain of ideology. . . . The theory, then, is of an "ideo-affective" orientation toward the world directed towards subjects about which there is doubt. If the doubt is clarified by knowledge, this ideological orientation moves on to some other marginal and uncertain area. Increasing knowledge about man, nature, and society can be said to reduce the target area for ideological thinking.
> (Lane 1966,p. 660)

The controlling social relationships are less clear for Lane than they are for Bell. Lane does not concentrate on a set of behaviours which govern scientists in their actions. Rather he talks about the receptivity, within modern American society, to the products of knowledge production. Lane therefore ends up with an epistemological argument centered on the society as a whole and not on the scientific community. In comparing pre-knowledgeable and knowledgeable society Lane advances that pre-modern people are unable to reason with the same degree of abstraction or complexity that moderns do (1966.pp.653-4). In this analysis Lane includes some of the features which Bell had located in the scientific community. In parallel with universalism, Lane states that knowledgeable societies, in contrast with other societies, rely on objective criteria and not on the authority of the speaker in judging the validity of knowledge claims (1966.p. 655). Also, in parallel with organized skepticism, Lane states that in traditional societies ideas are "given by tradition". In contrast, knowledgeable "democratic" society "actively encourages concept formation to create classes and relationships which give a better account of observable phenomena" (1966.p. 655). In addition, as in the communalism of science, knowledgeable societies are open to free discussion (1966.p. 650) and evaluate knowledge on the basis of shared public standards (1966.p. 656).

Ultimately, Lane's vision of modern society is consensual. In the definition of the knowledgeable society quoted above. Lane states that in the domain of "pure knowledge" decisions are centered around "agreed-upon values".

This value consensus both shifts the focus of society to the production of objective means and is the product of this knowledge production as ideological conflict is displaced.

Both Bell and Lane adhere to a view of science as rational objective action with the production of facts as its outcome. For Lane,as the facts about the world are known,these displace ideologies which depend on uncertainty. For Bell,these facts are associated with more powerful techniques of manipulating the world with these new rational procedures displacing ideological methods of action. In an argument concerning the social conditions of scientific practice,Lane outlines what he sees as the features of modern society which nurture and make society receptive to the production of factual knowledge. In this outline consensus is emphasized. Bell also implies consensus with his emphasis on administrative procedures as neutral and apolitical. Bell,however,concentrates his argument on the features of scientific communities and sketches the social features of these communities which make possible the development of factual knowledge. He further argues that scientists will act politically in a rational,objective way in accordance with the ethos of their community. There is overlap between Bell and Lane in what they identify as social features which support scientific action. In their social arguments concerning science the socially autonomous objective epistemological status of science is preserved since their social arguments are directed at the conditions which support scientific practice and not the content of scientific reasoning itself.

III Controversies and Scientific Experts

The literature on scientific controversies in public policy debates suggests that scientists are not a calming, rationalizing force. Studies on public policy issues involving scientific debate have demonstrated that scientists have not displaced but have rather become part of political conflicts. The nuclear test ban debate (Gilpin 1962), nuclear power plant siting issues (Nelkin 1971), low-level radiation and flouride exposure (Mazur 1973), nuclear waste disposal (Fallows 1979), the DES residue issue (Hadden 1979), and airport expansion (Nelkin 1973, Milch 1979) present cases where conflicting scientists become political resources. The various sides in these controversies present scientists as experts to argue their case and to criticize their opponents (see also Nelkin 1975,1979; Benviste 1972; King & Melanson 1972).

The pervasiveness of conflict presented by these studies directly challenges the end of ideology position on the entrance of science in public affairs. As opposed to science having a rationalizing influence on politics the scientific expert is an asset used by interested parties to bolster or defeat a case. Scientists themselves are also demonstrated not to behave in a detached style in public debate:

> Experts tend to behave as other persons behave when they engage in controversy. Coalitions tend in general to solidify and disagreements become polarized when conflict becomes acrimonious. (Mazur 1973, p. 259)

It is also stated that scientists, because of their sense of working with facts in science, do not compromise in political situations, as do conventional political actors. Scientists tend to see one legitimate solution to a problem so that opposition is not respected(Gilpin 1962, p. 17). In addition, scientists are demonstrated to be instigators of controversy since they sometimes engage in political action as a reflection of their sense of social responsibility for their work(Nelkin 1971).

There are two basic stances, in this political interpretation of conflicting expertise, in explaining the nature of disagreements. One is that scientists are in agreement on scientific questions and are really divided by political considerations. The other emphasizes the existence of disagreement on scientific questions. In this latter case, scientists' political commitments are said to exert an influence on scientific reasoning.

The first, agreement on science position, is most clearly outlined by Gilpin(1962). Gilpin, in his study of the nuclear test ban debate in the United States in the late 1950's and early 1960's,explains the disagreements between scientists as not based on scientific issues, even though scientists described their opinions in very technical terms. Rather, he advances that their assessments were the result of non-technical considerations, including their political perspectives.

Gilpin describes how both sides in the dispute describe their position as an assessment of the technical feasibility of a nuclear test ban between the United States and the Soviet Union. One side stated "that it is technically feasible to devise a system" while the other advanced that "There are no technical methods to police a test ban" (Gilpin 1962 p. 226 emphasis Gilpin's). Gilpin argues, however, that both sides in the dispute actually do agree on the technical features of the problem. Both sides agree on the sensitivity of detection equipment and the measures which parties can take to cover clandestine tests. All scientific actors do not agree that there is a fool proof detection rate. Scientists are divided about whether a "good probability" of "100 per cent" is adequate to make the test ban feasible. Included in this assessment is the evaluation of the likely actions of the different parties toward the detection equipment. Will the Russians risk detection? Different answers to this question will produce conflicting assessments of the technical feasibility of policing a test ban. Total certainty of detection may or may not be considered necessary to deter the Russians from cheating. In addition Gilpin traces these scientists' assessments to their opinions on military strategy and the desirability of a nuclear test ban (Gilpin 1962, expecially chapter 9).

For Gilpin then the scientific components of the advice of scientists are neither controversial nor are they affected by political involvement:

> ...despite the wildly varying interpretations certain scientists have given to particular facts, no scientist has been guilty of altering the facts themselves. On the contrary, one discovers that the American scientists' professional commitment to the truth has universally overcome his personal disappointment with the nature of the truth.
>
> However, when the decision-maker asks the scientist-advisor what is the significance of a particular factor... for the technical feasibility of a nuclear test ban, the scientist's answer does not come solely from the realm of science.
> (Gilpin 1962 p. 301)

In contrast to Gilpin, Nelkin and Mazur have drawn attention to the interplay between scientific and political factors in the entrance of experts in public policy debates. Nelkin has shown that uncertainties on scientific questions have made it possible for scientists to construct different opinions and this uncertainty has generated public concern and political action (1979). In addition Nelkin has argued that scientists' political commitments have influenced their scientific work:

> The debates among scientists documented in these cases show how, in controversial situations, the value premises of the disputants color their findings. The boundaries of the problems to be studied, the alternatives weighed, and the issues regarded as appropriate - all tend to determine which data are selected as important, which facts emerge. (1979 ,p. 16)

Nelkin demonstrates this assertion in her discussion of a nuclear power plant siting dispute where groups of scientists in favour and opposed to the plant chose to focus on different aspects of the situation (1979,p. 63).

In a parallel argument to Nelkin, Mazur has developed a fairly detailed account of the low-level radiation and fluoride debates emphasizing what he labels as "ambiguities".

> ...the complex technical problems of the state-of-the-art require subtle perceptions of the sort which cannot be easily articulated in explicit form. When it is necessary to make a simplifying assumption, and many are reasonable, which simplifying assumption should be made? When data are lacking on a question, how far may one reasonably extrapolate from data of other sources? How trustworthy is a set of empirical observations ? These questions all require judgements for which there are no formalized guides and it is here that experts frequently disagree. I will call these points of disagreement "ambiguities" and I will demonstrate how they enter into technical controversy. (Mazur 1973,p. 251)

Mazur demonstrates the importance of these "ambiguities" in explaining disagreements between experts in a discussion of the "dose-effect" curves which relate the incidence of cancer to radiation exposure (1973,p. 253). Mazur outlines two models, the "linear" and the "threshold", which divide the scientists in this area. The threshold model states that there is a dose below which it is safe to be exposed. The linear model advocates that there is no safe exposure level. Both models are said by Mazur to be consistent with the available data so that it is impossible to tell which is correct.

> There is always an element of judgement in selecting one model over another empirically-consistent alternative. (1973,p. 254)

The question of empirical consistency, however, introduces an important non-judgemental element into Mazur's scheme. Is Mazur saying that science is in principle judgemental in all its facets, or is he saying that it is judgemental about objectively determined evidence? In practice Mazur tends towards the latter.

Mazur's general statement on ambiguities quoted above suggests that science is always judgemental. Subtle decisions are made in principle. On the other hand Mazur has described disputes between experts as existing within a non-judgemental collection of established facts when he discusses the dose-effect curve. Both sides are said to put forward interpretations which are consistent with "inconclusive" data (Mazur 1973,p. 252).

> We are in no position to say which one is "correct" given the indeterminancy of the present state of knowledge. (Mazur 1973,p. 252)

Mazur also indicates that some form of objective evidence could disprove one or other of the models:

> It is easily conceivable that new data could prove one model was wrong, but it is difficult to see how one could be proved correct. (1973,p. 254)

This analysis is based, however, on an interpretation of the adequacies of the data, by Mazur, as it relates to the question of cancer incidence. But, following Mazur's initial characterization of science, if the grounds upon which a model is found to be false are dependent on the subtle informal judgement of scientists doing research in the area, then the question of proof must be related to scientific practitioners. The adequacy of data makes no sense then as an explanation of disagreements. It is rather something which is determined by scientists in particular situations.

Mazur provides evidence for the judgemental aspects of the determination of the significance of data in a discussion of the rejection of discrepant data by conflicting scientists. He gives an example from the fluoride debates where both sides rejected the "scientific validity" of data which challenged their position (1973,p. 254). Mazur describes this type of action as occurring as an outgrowth of the initial disagreements which began because of ambiguity. However, this type of judgemental action calls into question the entire idea of ambiguous data as the foundation of disagreements.

Like Nelkin,Mazur advocates that political and social considerations can affect the way in which judgements are made by scientists.

> One's interpretation of ambiguous data is often tied to one's position on the innovation about which the controversy exists. Thus, since a "threshold" radiation dose-effect curve is more congenial to the realization of the nuclear power programme than a "linear" curve, it is not surprising that proponents of that programme are more likely than critics to believe that the "threshold" curve is the valid one.
> (Mazur 1973,p. 258)

Mazur also states that some of the scientists who argued for the linear model did so at least partly because it was the most conservative and therefore provided the greatest margin of public safety.

Although there is some variation between Nelkin, Mazur, and Gilpin in the extent to which they see conflict within science, all of them concentrate on the importance of uncertainty as a trigger for political action. Gilpin advances that there is actually scientific agreement in relation to the detection capabilities in the nuclear test ban debate and that scientists are really arguing over political factors. Nelkin and Mazur argue for more interplay between socio-political and scientific considerations. In their view, scientific uncertainties provide the opportunity for political factors to enter into debate and socio-political commitments are seen to affect the reasoning of scientists in the disputes. Gilpin's analysis can, however, be interpreted as consistent with Nelkin and Mazur with respect to uncertainty. Gilpin states that scientists in the test ban debate agree on the extent of the uncertainty over the sensitivity of detection techniques. The political judgements which are brought to bear are oriented toward the interpretation of this uncertainty. Therefore, as in Mazur and Nelkin, uncertainty is the springboard for conflict.

The political and the end of ideology approaches differ in the extent to which they see science as providing solutions to technical problems. The political approach accentuates the existence of uncertainty while the end of ideology approach concentrates on the achievements of modern scientific techniques.

The existence of conflict is an important area where the political and the end of ideology approaches also differ. Nelkin and Mazur accentuate the existence of conflict within the science involved in the public debates, and in the political influences on scientists. Gilpin highlights the political confrontation style of behaviour of scientists and the uses of scientific experts by interested parties. Lane and Bell, on the other hand, postulate a consensual incremental science, independent of political influence, with the behaviour of scientists governed by a rational ethos, and the use of scientific experts in a rational administrative way.

There is, however, a great deal of similarity in the image of science relied upon by these writers. All of them, with the possible exception of Mazur, treat science, explicitly or implicitly, as a fact-gathering objective activity. Mazur emphasizes the informal judgemental aspects of scientific work and argues that commitments outside of this work can affect its direction at points of judgement. This judgemental view is however cross-cut in Mazur's account by a treatment of ambiguity and empirical consistency in science which implies that science is a cumulative fact-finding activity. This latter strain in Mazur's reasoning, like the treatment of science by Gilpin and Nelkin, is in some respects consistent with the accounts of Bell and Lane.

IV The Sociology of Science

Sociological writers have traditionally exempted natural scientific reasoning from sociological explanation. Scientific ideas are seen to be conditioned by the external physical world and not subject to social influence. This perspective comes through very clearly in the cases of Stark 1958,p. 165-76, Mannheim 1936,p. 270 and Merton. Merton concentrates his analysis on an "ethos of science" (1968,pp. 604-15) which circumscribes the behaviour of scientists in their community based investigations. The ethos is a social behavioural formulation of scientific method and the content of science is the result of the application of this ethos. In this view scientists are forever critical of knowledge claims (organized skepticism) which they evaluate using objective standards (universalism).

Some recent work in the sociology of science has challenged the conventional fact-finding view of science elaborated or implied by most of the writers above. In this new sociological view science has been characterized as a socially grounded activity with no special epistemological status (for example Barnes 1974, p. 43; Bloor 1976, pp. 2-5). A change in the characterization of science permits a reconsideration of disagreements between scientists as experts. I do this below in two stages. First I argue, using Kuhn, that the content and practice of science is community based. Below I demonstrate that this image of science is shown to be applicable to the explanation of conflicting experts through a discussion of Robbins and Johnson's analysis of the low-level insult debate. Second, the concept of the cohesiveness of cognitive communities is questioned through a concentration on the interpretive actions of scientists. It is argued that an interpretive view makes clear the consideration of external pressures on scientific advice. From this discussion the major features of the thesis analysis are outlined.

In developing the argument concerning cognitive communities in science it is best to focus on the work of Kuhn. Much sociological work on science has been influenced by studies in the history and philosophy of science and Kuhn is perhaps pre-eminent in this (for others see Mulkay 1979, pp. 27-62). He is,with the possible exception of Merton, read and referred to by sociologists of science more than any other person. In this discussion I restrict my focus to some of the general features of his perspective which make the argument that scientific thought is community based (for detailed discussions see Lakatos and Musgrave 1970).

Kuhn in his book The Structure of Scientific Revolutions (1970) outlines a view of science as a community based symbolic activity. Science is characterized by the community adoption of paradigms or models of what the world is like and how science is done (1970.p. 10). These models of work in science are not held at arms length by scientists but constitute the way that scientists see and manipulate the world. For Kuhn science is not the interpretation of objectively determined facts. Facts are constructed through paradigm determined operations.

> The operations and measurements that a scientist undertakes in the laboratory are not "the given" of experience but rather "the collected with difficulty" .... Far more clearly than the immediate experience from which they in part derive, operations and measurements are paradigm determined. Science does not deal in all possible laboratory manipulations. Instead, it selects those relevant to the juxtaposition of a paradigm with the immediate experience that the paradigm has partially determined. As a result, scientists with different paradigms engage in different concrete laboratory manipulations. (1970 p. 126)

The focus of Kuhn's argument is an explanation of scientific change. Kuhn describes change as revolutionary,with one paradigm succeeding over another while the scientific community is in a period of crisis. During periods of change scientists who operate within the old and the new paradigms are said by Kuhn to talk past each other because of the paradigm dependence of their discourse.

> When paradigms enter, as they must, into a debate about paradigm choice, their role is necessarily circular. Each group uses its own paradigm to argue in that paradigm's defence. .... the status of the circular argument is only that of persuasion. It cannot be made logically or even probablistically compelling for those who refuse to step into the circle. ....As in political revolutions, so in paradigm choice - there is no standard higher than the assessment of the relevant community. (1970.p. 94)

In summary, Kuhn characterizes science as a community based activity. Scientific action is constituted by paradigms or models of scientific practice. The symbolic component of science is not restricted for Kuhn to the interpretation of established fact, since what counts as fact is also the result of paradigm manipulations of the world. The dominance of paradigms is such that scientists within the same subject area who operate within different paradigms cannot make logical cases for members of the other paradigm community because their arguments presuppose their own paradigm view.

Robbins and Johnson (1976) have applied this "Kuhnian" image of science to the disagreements between scientists in the low-level lead insult debate. In this case there are conflicting scientific experts who make different evaluations about the safety of low levels of exposure to lead. Robbins and Johnson explain this difference as a conflict between two scientific communities, occupational toxicologists and geochemists. The controversy between these communities centers around whether there is a threshold, a level of lead exposure below which it is safe to be exposed.

The supporters of the lead threshold work are from within the tradition of occupational toxicology. The methods and skills they use are derived from medical techniques focussing on the identification of toxic levels in humans. The human organism is seen as being able to manage small amounts of lead with the great majority of the population considered to be safe because they are not exposed to "abnormally" high toxic concentrations. Non-toxic levels (below threshold) are considered "natural" since they are seen to be within the scope of the body's defence mechanisms. Here is an illustrative passage from Robbins and Johnson:

> Many clinical and physiological investigations reported in the last thirty years have failed to reveal one iota of evidence that existing levels of lead exposure pose any immediate threat to urban populations... there is scarcely an element common to man that does not exhibit a critical threshold for damage. Fortunately many of these levels, including lead, have been established and accepted. (cited in Robbins and Johnson 1976, pp. 358-9)

A major assailant of the threshold concept operated from within a different perspective, that of geochemistry. The method used to establish the "natural" level of lead is that of geochronology. "Natural" levels are established as those existing in pre-industrial settings. The "natural" levels of occupational toxicologists are assailed as only "normal" in the present situation. Here are some of their remarks:

> The acceptance of typical lead levels in humans in the United States today as normal and therefore as safe or natural is founded on nothing more than an assumption that these terms are equivalent. On the contrary... the 0.25 ppm level of lead in blood, which has been and still is regarded with illfounded complacency actually seems to lie between the average natural concentration of 0.0002 ppm and an acute toxic threshold of .5 to .8 ppm. This suggests clearly that the average resident of the U.S. is being subjected to chronic lead insult. The threshold for damage concept, as applied to lead, is an ill-defined opinion unsupported by any evidence. (cited in Robbins and Johnson 1976, p. 358)

The accusations of both parties of the lack of any evidence to support the opposition's assertions are understandable in terms of the different styles of work. The evidence produced by both sides relates to different criteria of what is natural and therefore harmful. What stands as evidence for one perspective does not count as compelling for the other.

Robbins and Johnson's account of the lead insult debate is essentially non-political. Scientists are locked in conflict over lead insult and their opinions spring from their community base. They do not reflect the external political commitments of scientists. This is an important feature of this style of work as compared to the end of ideology and the political interpretations referred to above. It is not necessary to refer to political commitments to explain disagreements because the possibility of differences in scientific practice can be routine. This does not, however, preclude the role of political factors and in a real sense makes their influence less problematic. These political elements are considered below in the light of an evaluation of interpretive action in science.

V Science as Interpretive Action in the Sociology of Science

Some recent work in the sociology of science has characterized science as interpretive action. There has been a concentration in this work on the variable use of symbolic resources within science. Norms of behaviour within science are seen to be continually negotiated. (For this perspective in sociology in general see Wilson 1970.)

A distinction which has been used in the discussion of these matters is that between social norms and cognitive/technical norms. Social norms are behavioural prescriptions centering on the procedures of scientific action and not directly tied to the content of any particular science. The Mertonian functionalist argument in relation to science accentuates the importance of social norms. Universalism would be a social norm of science.

> The mores of science possess a methodologic rationale but they are binding, not only because they are procedurally efficient, but because they are believed right and good. They are moral as well as technical prescriptions.
> (Merton 1968,pp. 606-7)

Cognitive/technical norms are images of what the world is like and what constitutes an adequate scientific action in relation to that world.

Mulkay has written extensively on this analytic distinction and he has in his arguments developed a concentration on interpretive action. Some of his arguments are followed below in the process of outlining a framework for the consideration of conflicting expertise.

At first,Mulkay criticized the Mertonian normative tradition and argued,using Kuhn,that scientists were governed by cognitive/technical norms.

> I would like to demonstrate the inadequacy of this functional view by showing how scientific theory and methodological rules operate as <u>the dominant source of normative controls</u> in science and, in fact, as a basic hindrance to the development and acceptance of new conceptions. (Mulkay 1972,p. 126)

Mulkay supported this assertion by demonstrating the response to deviance in science did not conform to the Mertonian normative tradition. By citing the case of Velikovsky, Mulkay demonstrated that scientists behaved in contravention to these norms. For example some scientists violated the norm of communality by attempting to block the publication of Velikovsky's work (1972,p. 129). This was done because of the cognitive and technical commitments of these scientists.

The violation of these social norms has not, however, been confined to the reaction to extreme deviance. This has been recognized to be far more pervasive within science. The concept of counter-norm has been the functionalist response to this common occurrence. The most detailed counter-norm argument has been provided by Mitroff (1974) where he argues that all of the ideal norms of science are balanced with counter-norms (1974,p. 73-9). For example,the norm of community is countered by the norm of secrecy. Mitroff advances that secrecy prevents out and out warfare in science by protecting the ideas of a scientist until they are mature enough to make a knowledge claim. Otherwise there would be constant stealing and this would cause the community to break down (1974,p. 75). In addition,the recognition of secrecy is pointed to by Mitroff as a motivational spur for scientists since to be secretive is to evaluate one's own work as valuable enough to steal (1974,p. 76). In support of his assertions,Mitroff provides extensive interview data on moon geologists, where scientists describe their use of these counternorms and evaluate them as desirable. Mitroff argues that both sets of norms are essential to the smooth functioning of the scientific community (1974,p. 76).

In later work Mulkay (1979, 1976) has argued that the functionalist norms of science are not institutionalized norms since rewards are not distributed for conformity to them (1979,p. 68). The behaviours which are the focus of rewards in science are contributions to the formal literature of science (1979,p. 69). Mulkay argues against Mitroff and Merton and states that these norms and counter-norms are evaluative vocabularies which are used in various ways by scientists to account for actions.

> In science, then, we have a complex moral language which appears to focus on certain recurrent themes or issues; for instance, on procedures of communication, the place of rationality, the importance of impartiality and commitment, and so on. . . . the standard verbal formulations to be found in the scientific community provide a repertoire or vocabulary which scientists can use flexibly to categorize professional actions differently in various social contexts. (1979,p. 71)

Mulkay further argues that one of the major pressures on scientists in their choice of verbal formulations is their "interests or objectives". Mulkay documents this pattern of use by referring to his own study of radio astronomy and the issue of secrecy. In this case a group of scientists at Cambridge, who were in the forefront of the research into the discovery of pulsars, were protective of some of the information they had generated. They were accused by other scientists of impeding the advancement of science by restricting the

flow of information (universalism). The Cambridge scientists were, however, able to marshall arguments, citing general principles, in favour of their restrictive actions (secrecy). The interests of different groups of scientists in gaining access to, or protecting, information, dictated their use of vocabulary elements in relation to the flow of information.
Mulkay concludes that this episode indicates that there are no sanctions in relation to social norm violation.

> ...conformity to social norms is irrelevant to the receipt of rewards, that despite the heated differences of opinion at the time of the pulsar discovery about the propriety of the actions of the Cambridge group, six years later two of its members received a Nobel Prize based in large part on this discovery. (1979.p. 71)

It is important to note that in this latter formulation Mulkay has shifted his analysis from the dominance of cognitive/technical norms to an explanation of the use of social normative vocabularies in terms of a range of motivational factors including interests. This reflects a change in Mulkay's reasoning concerning cognitive/technical norms which he now states are also part of the symbolic resources available to scientists and as such do not determine action in any straightforward way.

> Both the social and the technical culture of science appear to provide members with flexible symbolic resources which can be, and are, combined to devise a considerable variety of interpretive positions in connection with a common research problem. (Mulkay 1979.p. 78)

This interpretive use of cognitive/technical resources extends for Mulkay to, among other things, the investigation of the world and the justification of scientific actions. One of the pieces of evidence Mulkay presents to support his argument concerning the flexibility of meaning is a study of gravitational wave research by Collins (Collins 1975). The criteria to judge what was acceptable as a contribution were not clear since it was a fairly new area of inquiry. Researchers drew upon their science's symbolic resources in different ways to construct competing arguments of what was the appropriate way to define and approach the object of study. In this way it is demonstrated that meaning is negotiated and variable within a scientific community.

The use of technical resources to justify action is demonstrated by Mulkay with reference to Wynne's analysis of the treatment of the work of Barkla and the J phenomenon within the British scientific community (Wynne 1976). Barkla, a leading member of the British physicists' community in the early part of the twentieth century, had developed a set of arguments centering around what he referred to as the J phenomenon, an experimental effect produced through x-ray scattering. The generally accepted history of the refutation of Barkla's work within the scientific community is described by Wynne as "clearcut and resolvable according to rational rules of scientific practice" (1976 p. 308). Wynne argues, however, that Barkla's work was rejected for a complex of factors including differentiation within the scientific community.

> Thus the "scientific" reasons given in the literature at the time can be regarded more as rationalizations of a rejection... (1976, p. 308)

Wynne demonstrates the lack of application of these scientific reasons in the rejection of Barkla's work through a detailed analysis of the refutation arguments made by scientists. The conclusion which Mulkay draws from this discussion of these and other studies is that both the social norms and the cognitive/technical elements associated with scientific communities do not determine action but are rather interpreted in particular social contexts.

> I have argued, in contrast, that neither of these kinds of rule has a determinate meaning for participants and that implementation therefore requires a continual process of cultural reinterpretation. By means of this process scientists construct their versions of the physical world. (Mulkay 1979, p. 95)

When phrased in this open-ended way, an interpretive approach clearly conflicts with the normative Kuhnian image outlined above. This perception of conflict is of course dependent on readings of Kuhn and the interpretive approach. Law and French have argued that Kuhn has suffered from a "normative" reading and that Kuhn can be read to be "at least consistent with an interpretive analysis of action" (1974, p. 588). In doing this they rely on statements by Kuhn that it is important to investigate the way ideas are used by scientists and that this use may not be entirely uniform (see Kuhn 1970, p. 188). In addition they concentrate on Kuhn's term "puzzle-solving" and argue that puzzles are always in some sense unique, involving the extension of an existing paradigm to cover unexpected contingencies. This they do while stating that other aspects of Kuhn's work have far more normative implications. The issue of what Kuhn actually means is of marginal interest. What is more important are the concepts which are being discussed here and the idealization of Kuhn which is traded on in this discussion.

I believe an interpretive approach can allow for both the routine and the orthodox. For analytic purposes I accept that all action, including scientific action, is interpretive. That is, all action is made possible by a symbolic structure which is socially located, and further, that community members interpret the symbolic resources available to them in constructing their practical actions. It does not, however, follow that meaning, and therefore action, cannot be determined for members of communities. To say that symbols are interpreted is not to say that this interpretation is in principle innovative or flexible. In short, the "Kuhnian" model is in some cases applicable to scientific communities. It makes sense therefore to speak of schools of thought and certain scientific models as determining scientific action in certain contexts. In this way Robbins and Johnson's account of the lead disputes as disagreements between scientific communities becomes a reasonable form of explanation.

One major difference, however, between a "normative" and "interpretive" approach in these matters is that consensus and uniformity are not assumed for the interpretive analyst (see Law and French 1974,p. 591). Whether it is intelligible to think of orthodoxy in a particular case must be explored and established.

One advantage of a focus on interpretive action is that it allows the introduction of motivational factors, other than the symbolic repertoire of science, into the consideration of symbolic action within science. This permits the more ready consideration of the influence of external cultural influences and the practical interests of scientists in particular social settings into the analysis of scientific reasoning (Law and French 1974,p. 589). This view is particularly helpful in the consideration of scientists as experts. As Mulkay has advanced:

> ... the way in which scientists interpret and draw on their expertise outside the research community will vary with the social setting in which they are operating and with their position within that setting. (1979,p. 113)

VI Toward an Interpretive Political Sociology of Scientists as Experts

The "end of ideology school" argues that scientists have a calming, rationalizing influence on public affairs. This view is based on a positivist image of science and a consensual image of society. This work has been challenged by some analysts who have examined specific cases of the involvement of scientists in public affairs. The major finding of these writers is that science does not displace political conflict but rather becomes part of and even perhaps spurs conflict. These writers concentrate on the conflict between groups as opposed to the administrative consensual use of science. Their view of science is, however, similar to the end of ideologists in the sense that science is still seen as the collection of facts. A major difference lies in their finding that there are uncertainties in the science associated with the public issues which they examine. Politics infringes because of these uncertainties. Science is, in a sense, less successful for them than for the "end of ideology" school and, as a result, does not displace political action.

The present work builds on a tradition within the sociology of science which allows no special epistemological status for science. Science is seen as symbolic activity which is practiced within particular social settings. Facts and uncertainty are, therefore, decided by scientists in particular social settings. The particular perspective which is adopted in the present study can be broadly referred to as interpretive. This perspective allows for a variation of the extent to which communities are uniform in their interpretive procedures. The focus on interpretive action also allows the consideration of a range of commitments arising in social situations which can propel this action. In relation to scientists as experts this means that the social situation within which the expert operates is the focus for the analysis of scientific expert opinion. Although indicated by the interpretive sociology of science literature, no study has been done from within this perspective.

This study is an attempt to begin an interpretive political sociology of expertise. The phenomenon of expertise is fundamentally a political sociology issue. Experts are used by various parties in modern society to argue the merits of a course of action, or a state of affairs. Expertise has become part of arguments over legitimacy and, therefore, the distribution of power.

Stuart S. Blume (1974) has tried to begin what he terms a political sociology of science. That is, he has attempted to analyze the interrelationship between scientific communities and centers of power within society, especially government (see also Doern 1972, Greenberg 1967). This research on the politics of scientific communities has not focussed on the phenomenon of expertise.

VII. Methodology: The Use of Interviews

In the literature on expertise, none of the writers engage in systematic interviews with an identified population. Nelkin argues for the utility of studying public controversies since she advances that they make the assumptions which normally guide action visible:

> ...in the course of disputes, the special interests, vital concerns, and hidden assumptions of various actors are clearly revealed. (1979, p. 7)

Nelkin's statement is purely programmatic since the status of public statements and how these are sifted to discover the underlying motivations is never established.

The opinion statements made by scientists are not in the present work accepted as straightforward indications of motivations. As Wynne has stated in a slightly different context in his analysis of the rejection of Barkla and the reasons for Barkla's rejection:

> Rationalization and Practice may overlap not at all, a moderate amount, or a great deal. ... In science, as much as in any other aspect of social life and culture, the distinction between rationalization and practice exists and must be teased out by sociological analysis. (Wynne 1976,pp. 337-8)

In the present study the opinions of scientists, which include scientific and non-scientific components, are considered as part of the symbolic resources available to participants in the pipeline debate. These symbolic resources can be drawn upon to reason about impact in a variety of ways. Their motivational implications are not always clear.

The idea that when people are challenged their true motives and opinions will come to the fore has limited currency within sociology. Garfinkel advocates that the assumptions of everyday life can be made visible by challenging what is routine (1967,p. 36). Garfinkel is,however, dealing with what is not able to be articulated in any standard way. The existence of background expectations is demonstrated,for Garfinkel, by the breakdown of normal interaction when people behave inappropriately. The public debates involving experts with their articulations of attitudes are different in that they are verbal forms of behaviour and not breakdowns. These situations do,however,also have background expectations. For example, Scott and Lyman have made this point in relation to excuses and justifications:

> The idiomatic form of an account is expected to be socially suited to the circle into which it is introduced according to norms of culture, subculture, and situation. (1970,pp. 132-3)

Similar points have been made with respect to motives (Mills 1940, Burke 1962). Also, as was argued above, recent work in the sociology of science has emphasized the importance of certain standard forms of communication within science (see especially Gilbert 1977). Scientists utilize symbolic resources available to them to argue in the public literature and in their less formal communications. All of these forms of communication are circumscribed and made intelligible by background expectations.

Controversy highlights conflicts of interest and can for the analyst clarify important features of issues which are not necessarily visible at times of relative calm. In this respect, Nelkin has a strong point. This does not mean, however, that the statements of participants during controversies are genuine indicators of their usual attitudes. The social setting within which the controversy is conducted circumscribes the communications which occur. This is somewhat more obvious in the present study where the debate occurs in the context of an inquiry. Inquiries have formal rules of procedure so that communications are more obviously constrained than in the general public domain. Constraints can, however, be subtle and informal. For example, with one exception, witnesses on biology at the Berger Inquiry made no socio-political arguments concerning the desirability of pipeline development. In contrast, almost all of the same witnesses who were interviewed for the present research managed to make political comments on pipeline development during the interviews. There was something about testifying in front of a commission which dictated that political statements by biologists were not appropriate in the context of biological evidence although this was never explicitly outlined as a formal rule of procedure. Correspondingly, the informal interview situation provided a setting where such statements seemed correct. The implications which are drawn from this finding concerning the real motivations of biologists are not immediately clear. On the surface,it demonstrates that scientists were capable of forming political statements in relation to this issue but it does not demonstrate how these elements may have entered their reasoning. This is the focus of the present research problem. My analysis of the social organization of experts and their interactions within the Inquiry is an attempt at constructing an image of the social context of scientists so that their verbalizations can be more clearly interpreted.

In the present study I assume that particular social occasions are not isolated but must be understood in the context of the relatively persistent arguments and perspectives of the discussion participants. This assumption makes intelligible the introduction of interviews since there is an underlying connection between the particular performances in the hearings and those in the interviews. In this sense, then, the interviews are an extension of the debates within the Inquiry.

The interviews produce three major forms of information. First they are an attempt to produce attitude statements by participants in a uniform way. In the Inquiry, all of the participants were not asked the same questions. Witnesses also appeared in panels of various sizes, sometimes alone, and for different lengths of time. The interviews were conducted using a standard set of questions by the same person. In this way the statements of participants can be compared. In addition all of the participants who were included in the study sample (see populations below) did not appear in the transcript as biological witnesses. The attitude statements of these persons can be compared with witnesses through the information generated by the interviews. This is one way in which the degree of integration of witnesses with their organizational client is explored.

The second form of information which was generated in the interviews is the evaluations by participants of their client sponsors, other organizations, and the Inquiry. This information is applied to the two social contextual problems in the thesis: the social organization of participants and the subjective dimensions of conflict within the Inquiry. I have begun with the premise that it is crucial to know the meanin g which participants give to events since action is dependent on meaning For example, the observation that industry associated scientists have worked for a long time with their clients does not tell us anything of the character of that relationship. These scientists' evaluations of this relationship are indicators of this character. In addition a comparison with the evaluations of other scientists of their relationships with their clients helps to establish different patterns of commitment and organizational integration (see Chapter 3 below).

The third form of information which is produced in the interviews is intelligence about the participants and their organizational relations. For example, many participants described how it was that they came to be witnesses or how they recruited witnesses for their organization. This information is used in this analysis of the structure of the client-expert relationship (see Chapter 3 below).

The interviews were open-ended in the sense that participants were allowed to reply to questions in the way that they chose. An effort was made to ask the questions in the same sequence. This did not always occur The open-ended nature of the schedule meant that sometimes a respondent would develop his answer in such a way that he addressed some of the subsequent questions (see Appendix I). Also, when the topic of the interview discussion had shifted in this way,I often asked the companion questions to the questions the respondent had inadvertently addressed. A taperecording of the interviews was made and the responses were transcribed.

All of the respondents did not reply to all of the questions. Respondents were more or less pliable in the interview situation. Some respondents were very eager to tell me their side of the story and took the initiative for at least part of the interview. In the vast majority of these instances I was able to keep track of the topics and complete the schedule. A more serious source of non-response came from non-scientists, who were lawyers or managers. These respondents, although co-operative, were very restricted in the time they could allow for the interivew. I had to abbreviate these interviews and, as a consequence, the rate of response was lower for these lay persons than for scientists.

The interview data form the foundation for the analysis but this is supplemented by the evidence which was presented at the Inquiry and the public statements made by participants. All of the sections of the Mackenzie Valley Pipeline Inquiry transcripts on the impact to the biota were examined(see populations below). This investigation, and a reading of the Berger Report(1977a, 1977b), formed the basis for the questions concerning the issues which involved biology. The interviews were conducted approximately one year after the conclusion of the Inquiry.

VIII. Methodology: The Populations

There is little attempt to identify populations in the study of scientists as experts. Gilpin, in his study of the test ban, defines his population. He states that he is not studying all scientific opinion on the issue but is studying the opinions of the politically "effective" scientists (1962, p. 7). Nelkin and Mazur do not define their populations.

The focus of the present study is on the biology debates within the Mackenzie Valley Pipeline Inquiry among scientists about the impact of pipeline development. The isolation of these discussions within the general body of the Inquiry and the populations associated with these discussions was accomplished in two basic steps: the identification of the public debate in the transcripts and the isolation of the Inquiry participants who were involved in this debate.

There was much biological talk in the public record of the Berger Inquiry on the impact of pipeline development. Much of this biological talk was generated by people who were not recognized as experts in biology. Two criteria were used to isolate "scientific" discussions. First, the evidence in the transcript must be presented at the Inquiry by a person who is formally recognized by the Inquiry as an expert in biology. Second, this information must be purported to be on the impact to the biological environment. The phrase "purported to be" is important here since a biologist may have actually offered opinions on things other than biology in the course of his testimony. In addition, this criterion excludes the testimony of biologists whose evidence purported to be about non-biological components. For example, some aquatic biologists' testimony purported to be about the human use of the biological resource, the fisheries, so that the testimony by these witnesses was excluded from study.
The expert witnesses who met these criteria were included as part of the population of scientists under study. Thirty-one expert witnesses were included for study using these criteria. I interviewed twenty of these witnesses.

These people do not, however, exhaust all of the scientists who were directly involved in the biological discussions. For example,lawyers in the hearings relied heavily on biological advisors in their lines of questioning. The biological advisor would suggest areas which could be questioned in the testimony of a witness and the lawyer would pursue the issues suggested. Participants who were interviewed related how this lawyer-advisor relationship would appear, on occasion, on a question by question basis. The advisor would suggest a question to the lawyer. The lawyer would ask it. There would be a reply. The advisor would suggest a follow-up question (in whispers or on a piece of paper), and the cycle would continue. In this case the person who is developing the line of questioning, the advisor, does not appear in the transcripts.

In addition,there were scientists within the organizations who were involved in preparing and criticizing the environmental testimony. These people were discovered by the recommendations of Inquiry participants who were interviewed. When I interviewed participants I asked them who would be an important person to talk to with respect to the biological environmental presentations. The recommendations were often repeated. I was able to interview three of five scientists who were identified on this basis. These were added to the twenty identified as witnesses. This number was small because of the high degree of overlap between witnesses and advisors. At least twelve of the scientists who were identified as witnesses could also be clearly identified as advisors. In addition,all three of these other scientists interviewed as advisors had also acted as witnesses, but did not qualify under the inclusion criteria.

Scientists in the Inquiry were involved in the debates on behalf of organizations. There were six organizations, including the Commission, which presented testimony in biology (see Chapter 2). These organizations were staffed primarily by lay persons, that is, by people without scientific training in biology. Some of these people were directly involved in the presentation of biological arguments. I included these participants in the study to gain an appreciation of the organizational dimensions of the debate.

Eleven people acted as counsel either in directing biological testimony or in its cross-examination on behalf of these organizations. I interviewed nine of these people. Other lay persons aside from counsel were involved in preparing and criticizing the testimony in biology. I identified these people both through their appearance in the transcripts and through recommendations. I interviewed five of the seven people who were identified in this way.

I interviewed 65% of the witnesses (n=20), 60% of the scientific advisors (n=3), 82% of the counsels (n=9), and 71% of the lay advisors (n=5).

The number of witnesses interviewed in relation to their organizational affiliation is as follows: 2 of 3 for the E. P. B., 5 of 6 for Arctic Gas, 3 of 4 for Foothills, 2 of 3 for the Commission, and 8 of 15 for COPE and CARC combined. An attempt was made to interview the entire populations outlined above. People were contacted at first by letter (see Appendix II). Whether or not I received a reply, I telephoned the person and attempted to arrange an interview time. All of the witnesses whom I was able to contact were willing to discuss their opinions and experiences. I was constrained somewhat in my schedule, in that I could afford only one cross country trip to western Canada. The interview rate is, therefore, a reflection of scheduling and travel limitations. The poorer interview rate for COPE and CARC witnesses reflects these organizations' use of government scientists, who often have geographically scattered and remote postings, or are in the field on research assignments. The sample of scientists is biased toward consultants, who locate in southern centers, and academics. In relation to lay participants, there is less bias since all of these people were located in southern centers. This is reflected in a higher interview rate for laymen .

IX Methodology: Case Studies

The case study is perhaps the dominant form in the sociology of science. This research is a case study, that is, an exploration of a particular example of a phenomenon. All of the other expert debate studies discussed in this thesis are case studies. Case studies have both strengths and weaknesses. Their strengths lie in their open-endedness and in their attention to the complexity of the phenomenon. Their weaknesses lie in their difficulties with comparability, and with their inability to conclusively test propositions.

The flexible nature of case studies is widely recognized.

> What features of this approach make it an appropriate procedure for the evolving of insights? A major one is the attitude of the investigator which is one of receptivity, of seeking rather than of testing. Instead of limiting himself to the testing of existing hypotheses, he is guided by the features of the object being studied. His inquiry is constantly in the process of reformulation and redirection as new information is obtained. (Selltiz et al. 1959, p. 60; see also Glaser and Strauss 1967)

In the present study, I have been flexible in the development of the analysis. For example, the finding on the lack of parallel structure in debates was not looked for at the beginning of my research. Once I discovered this feature I reoriented the investigation. From this point, I started to develop the importance of the social organization of experts and the subjective dimensions of conflict (see Chapter 11). A fundamental shift also occurred in treatment of arguments and motivations (see Chapters 10 and 11).

The other strength of case studies, their detailed complexity, is evident in the present study both in the use of multiple methods and in the qualitative small-scale dimension of the study. Although the thesis narrative is structured around the interview responses, this should not obscure the importance of other materials. I systematically analyzed the approximately fifty volumes(days) of testimony relating to the biota. This reading formed the basis of the interview schedule. The transcripts are also quoted and referenced extensively in the narrative. In addition, I use other material, including journalistic accounts, to construct a picture of events. The qualitative dimension of this study limits its size. The populations are small, so the numbers in tables are not the cornerstone of the analysis(see Appendix III). I quote extensively from the interviews to justify my reading of events and to make my data visible.

The most fundamental drawbacks of case study research are the difficulties of comparison and the testing of propositions. If multiple data sources are used in a qualitative flexible way, how are different studies to be compared? And further, how typical is the particular case of the phenomenon, so it can act as a test of general propositions? The first question has been addressed most centrally in this study in relation to the use of interviews, versus the reliance on primarily public information in most other case studies on experts(see above and Chapter 11). The second question, on the typicality of the present case and how this affects the testing of generalizations, is also germane. There are few case studies on this topic, so it is difficult to judge its representativeness. This issue is considered throughout the study, most notably on the relative importance of interest groups and scientific communities for structuring debate(see Chapters 3 and 9). The real test of generality is further comparative study. As Barber and Fox in their sociology of science study of serendipity have clearly stated "A large enough series of such case studies could suggest how often and in what ways these factors(and others that might prove relevant) influence [phenomena]" (1958, p.136).

X. Chapter Outline

There are eleven chapters in this study. The first, this chapter, is an introduction. In Chapter 2,I introduce the Mackenzie Valley Pipeline Inquiry and outline: the organizations which took part, the public debate over biology, and the scientists who were involved as witnesses in the debate. Chapter 3 is an analysis of the social organization of biologists in the Inquiry. This beginning arises from the sociological imperative that the social or group context of action must be the starting point for analysis. In the next two chapters,I explore the subjective dimensions of conflict within the Inquiry,both among groups of participants (Chapter 4) and between the participants and the Commission itself (Chapter 5). I reason that the various Inquiry experiences of participants are important to understand in an analysis of participants' opinion statements.

The following five chapters are a consideration of various dimensions of participants' opinions on the impact to the biological environment of Mackenzie Valley Pipeline development. Chapters 6, 7, and 8 discuss aspects of the debate which are external to biology. In Chapter 6,I analyze participants' attitudes on the desirability of northern development. In Chapter 7,I examine the technical and behavioural features of the definition of the pipeline event. In Chapter 8,I consider the differences among participants as to whether they accepted a restricted or broad definition of the pipeline event.

After a consideration of these clearly non-biological matters, I analyze in Chapter 9 the scientific issues of the relative vulnerability of arctic ecosystems and species to disturbance and of the adequacy of knowledge to see whether participants' positions on these issues are related to their impact assessments. In Chapter 10,I examine the question of how participants argue about the significance of uncertainty for action. Chapter 10 also includes a general summary of the structure of scientists' arguments on all of the debating issues covered in Chapters 6 through 10. Throughout the analysis of scientists' opinion statements I try to assess the importance of each of these issues to the reasoning of scientists. In Chapter 11,I summarize the main theoretical points raised in the thesis, make recommendations for further research, and suggest practical implications of this research.

CHAPTER 2

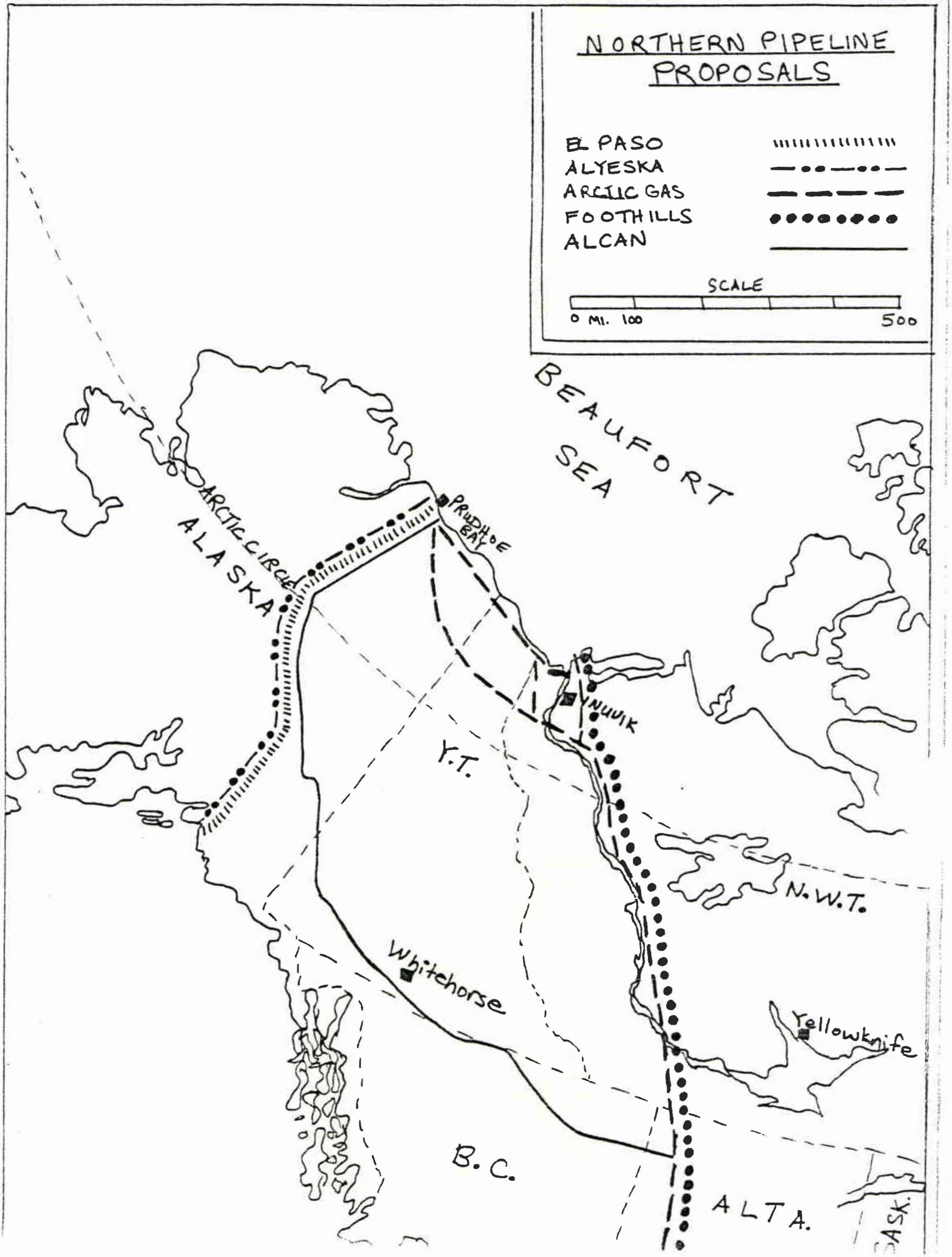
BIOLOGY AND THE MACKENZIE VALLEY PIPELINE INQUIRY

As a prelude to the dissertation,I present in this chapter an overview of the Mackenzie Valley Pipeline Inquiry and the participants at the Inquiry. This chapter is divided into four major sections. First,I outline the pipeline proposals which were brought forward at the Inquiry. Second,I consider the nature of the Inquiry. Third,I examine the role of the biological evidence in the Inquiry. Fourth,I summarize the biological evidence.

I The Development Proposals

The Mackenzie Valley Pipeline Inquiry was the scene of a corporate battle for control of gas transportation from the western arctic.
The principals in this action coalesced into two groups who wished to construct pipelines across Canadian territory; the Canadian Arctic Gas Pipeline Limited consortium (hereafter Arctic Gas) and Foothills Pipeline Limited (hereafter Foothills). A third corporate actor, El Paso, put forward a proposal to carry American gas from Prudhoe Bay in Alaska (see map p. 51 below) across only American territory and therefore was not involved in any of the Canadian hearing processes.

Arctic Gas was the major contender with the largest number of corporate backers (as many as 28, Gray 1979) while Foothills, an alliance of


NORTHERN PIPELINE PROPOSALS
EL PASO
ALYESKA
ARCTIC GAS
FOOTHILLS
ALCAN
SCALE
0 MI. 100
500
BEAUFORT SEA
PRUDHOE BAY
ARCTIC CIRCLE
ALASKA
INUVIK
Y.T.
N.W.T.
Whitehorse
Yellowknife
B.C.
ALTA.
SASK.

three corporations was the dark horse. Foothills won out over Arctic Gas and El Paso after an arduous and complex political debate in both Canada and the United States (see Bregha 1979, Gray 1979).

All of this corporate action developed after the mammoth oil and gas strike at Prudhoe Bay in Alaska in 1968. The western arctic became a focus of interest for future sources of oil and gas. This interest was considerably heightened after the Middle East oil embargo of 1973 and the energy crisis which followed. The oil from the Prudhoe Bay field was transported along a pipeline across Alaska to the port of Valdez (see map, Alyeska) where it was put in tankers and shipped to the American west coast. The El Paso proposal was to do essentially the same thing for gas.

Arctic Gas proposed to build a gas pipeline from Prudhoe Bay in Alaska across the northern Yukon and up the Mackenzie Valley to American and Canadian markets. Arctic Gas had two possible routes for crossing the Yukon (see map, Arctic Gas). Their prime coastal route was to follow the North Slope, or coastal plain of the Yukon, beside the Beaufort Sea to the Mackenzie Valley. Their alternate interior route was to travel inland where it would join up further up the Mackenzie Valley with the valley section of the pipeline. The Arctic Gas pipeline was to start out with American Prudhoe Bay gas and link up with the projected Canadian gas field in the Beaufort Sea near the Mackenzie Delta. One pipeline would be used to transport gas from these two fields. To accommodate the volume of gas anticipated, the pipeline would use 48 inch diameter pipe, larger than any other pipeline in North America, operated at a pressure higher than any previous pipe. The pipeline would be buried and chilled. The chilling of the pipeline below the freezing point of water would prevent the frozen ground through which the pipe would pass from melting. The construction was to take place primarily in winter from a road of compressed and artificial snow. The snow roads were proposed as a way of protecting the terrain surface, which if scarred would result in the melting of the permafrost layer below (for details see Berger 1977, chapter 3).

The membership of Arctic Gas fluctuated. Three of the major gas development interests in the Mackenzie region, Imperial, Shell, and Gulf, and the largest pipeline transmission company in Canada, Trans Canada Pipelines, were constant members of the consortium. Another member was Alberta Gas Trunk Lines (hereafter Trunk Line), the company which broke away to form Foothills.

Trunk Line, the second largest Canadian pipeline carrier, had been involved in developing plans for the transmission of western arctic gas since 1970. Other studies were also begun at this time by another group which included Trans Canada Pipelines and the three major gas development interests. All of these parties merged under the corporate umbrella of Arctic Gas in 1972 (see Gray 1979, chapter 4). In September of 1974 Trunk Line broke away from Arctic Gas to form, along with Westcoast Transmission Company, Foothills.

Foothills entered the pipeline competition with two proposals. The first was filed with the National Energy Board in March 1975. The Maple Leaf Line, as it was called, would be a direct line up the Mackenzie Valley carrying Canadian Gas from the Mackenzie Delta to southern markets (see Foothills on map). This pipeline was at first proposed to be 42 inches in diameter but was later upgraded to the Arctic Gas size of 48 inches, although at a lower pressure (Peacock 1977.p. 95). The Foothills pipeline was also to be buried, chilled, and constructed in winter using snow roads. In May of 1976, Foothills entered into an agreement with Northwest Pipelines in the United States to build the Canadian section of a pipeline which was to carry only American gas along the Alaska Highway route (see Alcan on map p. 2). This complementary proposal to the Maple Leaf line was to construct a pipe to carry American gas from Prudhoe Bay along the oil pipeline corridor to a point where it would cross the southern Yukon along the Alaska Highway. This project was not considered in the Berger Inquiry since it appeared late and skirted the region dictated by the mandate of the Inquiry. Judge Berger did, however, mention in his judgement that he felt that a more southerly route along the Alaska Highway would be more environmentally acceptable (Berger 1977a, p. xiv). The Alaska Highway proposal eventually won the approval of the Canadian and American governments as the best way to begin the northern transportation of natural gas from the western arctic. Foothills has concentrated its efforts in this area and the Maple Leaf project has been shelved.

All of these projects were expensive. The Arctic Gas proposal was projected by Arctic Gas in 1976 to cost 7.4 billion dollars (Canadian Arctic Gas 1976). This was to be the most expensive private enterprise undertaking in North American history. The Alaska Highway proposal was projected in 1980 to cost 21 billion dollars as costs have continued to escalate (Anderson 1980).

II The Mackenzie Valley Pipeline Inquiry

The Mackenzie Valley Pipeline Inquiry occurred in the context of a wide-ranging debate on the desirability of arctic pipeline development. The issues which surfaced in this discussion included: the nationalistic advisibility of transporting American gas across Canada, the energy issue of the assessment of need for arctic gas, environmental concerns, and the socio-political interests of the native peoples in the Mackenzie region who wished a settlement of land claims and some control over development. These debates became centered on government hearings. Three hearings sat during the same broad time period to deal with the same basic subject: the United States Federal Power Commission hearings, the Canadian National Energy Board Northern Pipeline Hearings, and the Mackenzie Valley Pipeline Inquiry.

The Federal Power Commission Hearings in the United States under Judge Naham Litt were aimed at assessing the overall desirability of the various proposals for transporting Alaskan gas (see Litt 1977).

The Arctic Gas and El Paso proposals were joined at a late stage in the hearings by the Alaska Highway application. This hearing commenced on May 5, 1975 and concluded November 12, 1976. These hearings ruled in favour of the Arctic Gas application.

One of the two hearings in Canada was the National Energy Board (hereafter N. E.B.) Northern Pipeline Hearings. The N. E.B. is an agency of government engaged in fact-finding, granting permits, and making recommendations to cabinet on government energy policies. The N. E. B. held its Northern Pipeline hearings to assess the desirability of the various proposals which crossed Canadian territory. The N. E.B. 's focus was on technical and financial questions related to the pipeline, with less emphasis on social and environmental factors. In all of these deliberations the N. E.B. is supposed by its charter to consider the national interest.

The N. E. B. hearings were from the beginning plagued by controversy. A first set of hearings under the chairmanship of Marshall Crowe was ruled invalid after a Supreme Court decision that Crowe could be seen to have a bias in relation to the proposals he would judge. Crowe, the chairman of the N. E.B., had been president of the Canadian Development Corporation, a crown corporation with a broad set of holdings, before he assumed his position at the N. E.B. The C. D. C. was a member of the Arctic Gas consortium and Crowe had been involved at an early planning stage as C. D. C. representative on the Arctic Gas board of directors. Crowe had been a member of a management committee for about a year and was involved in 7 meetings with Arctic Gas. On October 4, 1973 Crowe left the C. D. C. to assume the chairmanship of the N. E. B.. Arctic Gas filed its application before the N. E. B. on March 21st 1974, 6 months after Crowe migrated. This set of events caused some groups to question, not the integrity of Crowe as an individual, but that a "reasonable apprehension of bias" could be made in relation to Crowe's assessment of the Arctic Gas application. Over three months of hearings were set aside and another set of hearings were started under a new panel. These hearings began on April 12, 1976 and ran until May 13, 1977 (for details see Gray 1979, chapter 5, Peacock 1977, Bregha 1979, see also Bliss 1978a, 1978b, Ritchie 1978).

The Mackenzie Valley Pipeline Inquiry conducted by Justice Thomas R. Berger was the other major Canadian inquiry on these issues. Judge Berger was directed to assess:

> The social, environmental and economic impact regionally, of the construction, operation and subsequent abandonment of the proposed pipeline in the Yukon and Northwest Territories. (Privy Council 1974.p. 2)

He was also to recommend terms and conditions which should be imposed if a pipeline were approved. In addition, Berger was asked to examine "The specific environmental and social concerns set out in the Expanded Guidelines for Northern Pipelines" (Privy Council 1974,p. 2). This other document mentioned the idea of an energy corridor of development in the Mackenzie Valley area (Government of Canada 1972). Judge Berger interpreted his mandate broadly to consider this corridor as the object of his assessment (see chapter 7 below). The Inquiry was formed on March 21, 1974 and it tabled the first volume of its report on May 9, 1977 (Berger 1977a). The hearings themselves started on March 3, 1975 and continued until November 19, 1976. The transcripts of these hearings run to 281 volumes, with each volume representing one day of testimony.

Judge Berger is a former leader of the New Democratic Party in British Columbia. Before he became a judge, Berger had defended native people's interests in court, most notably with the Nishga case. Here he argued before the Supreme Court of Canada in favour of the recognition of aboriginal rights (DINA 1974). His appointment to head the Inquiry came at a time when the Federal Liberal Government was in a minority position, with the New Democratic Party holding the balance of power (Dosman 1975, p.193). Judge Berger's background reflected the conflicts which the Inquiry perceived as occurring between it and the government. For example here are some remarks made during an interview for the present study by one of the senior officials in the Inquiry:

> Government was after the Commission in a negative sense almost from the beginning...When it was apparent that he took his job seriously, that he was going to engage in a really extensive investigation, they began to get gunshy (sic).... they began to cut off money. They began to make experts hard to get. I remember at one place they wouldn't allow civil servants to testify. Then they indicated that the decision would be made before the report was available, and they began to pick at us.

The Inquiry felt at odds with the government and one of the ways that it coped with this distance was through the media. Here are some further remarks from the participant quoted above:

> .... the bureaucracy and the government got down on the Inquiry after a while and the media was our protective device. When government put unconscious or deliberate pressure on us to hurry up or to do this or to do that there were two things we could do: we could either submit to it, which we didn't want to do, or we could say don't tussle with us. And the way that we dealt with that is through the media...

There were other factors cited by Commission associated participants for the high media profile of the Inquiry. The Inquiry was stated to be charged with publicizing the issues and encouraging public debate. In addition it was seen to be essential to have a high media profile to allow intelligent presentations from the communities of the north which the Inquiry visited. To this end the Canadian Broadcasting Corporation had daily summaries of the inquiry hearings on its radio and television service in the region affected by the Inquiry. In the south there was almost daily coverage of some aspect or other of the pipeline deliberations. The Inquiry became the focus for a national debate on a great range of issues, including: the pattern of development which should occur in the north, the value of wilderness environments, and the rights of native peoples and their land claims.

The Berger Inquiry was divided into formal and community hearings. In the formal hearings the proponents of pipeline development and intervenors put forward the evidence of expert witnesses. This evidence was read into the record of the Inquiry and participants were allowed to cross-examine the witnesses on their testimony. The community hearings, held in 35 communities, followed a different procedure. Residents of these communities were encouraged to express their opinions on matters which they felt were related to pipeline development. There was no cross-examination on the community hearings. The community hearings fill 77 volumes of testimony while the formal hearings fill 204. The present study concentrates on the expert testimony in the formal hearings.

The formal hearings were divided into four main phases. Here is Judge Berger's outline of these phases:

> Phase 1: Engineering and Construction of the Proposed Pipeline.
> This phase of the hearings will include such matters as the size of the pipeline, its location, the timing of construction, the composition and deployment of construction crews, and the construction of compressor stations.
> Phase 2: The Impact of a Pipeline and Mackenzie Corridor Development on the Physical Environment.
> This phase of the hearings will include the impact on the land, the air and the water, and will cover such things as the effect on permafrost, river crossings, slope stability, and gravel and other borrow locations.
> Phase 3: The Impact of a Pipeline and Mackenzie Corridor Development on the Living Environment.
> This phase of the hearings will include the impact on plant and animal life, including wildlife, mammals and fishes.
> Phase 4: The Impact of a Pipeline and Mackenzie Corridor Development on the Human Environment.
> This phase of the hearings will include social and economic impact.
> (Berger 1974)

According to Berger these distinctions were for convenience only and evidence which did not fall clearly within these phases but was seen to be relevant would be included. In addition.new phases of the Inquiry would be added if it seemed appropriate (Berger 1974). This was done with the inclusion of a phase to consider the impact on the Mackenzie Delta and Beaufort Sea.

The biological sections of the Inquiry were important to Judge Berger's argument in his final report. Berger had two major findings. First, he stated that there should be a moratorium on development in the Mackenzie Valley for 10 years so that a settlement of native land claims could be made and native society could adjust itself to the changes which development would bring. Second, he advanced that a pipeline could never be built across the northern Yukon because of the impacts that this development would have on the biological environment. Since Arctic Gas wished to cross the northern Yukon,this ruled out any possibility of the Arctic Gas proposal being acceptable on biological grounds.

III Points of Discussion in Biology

The discussions during the Inquiry on biology ranged over many topic areas although they were primarily concerned with large animals. Insects, for example, were only considered insofar as they harrassed the Porcupine Caribou Herd. The following were the major areas of debate:

Vegetation:

Vegetation was discussed but it did not become a major biological impact issue: rather it figured more strongly in the engineering and physical impact debates. Discussion on vegetation revolved primarily around the revegetation proposals of pipeline companies and the effect of these schemes in re-establishing a cover over the disturbed terrain. Foothills planned to make a greater use than Arctic Gas of native species of grasses as opposed to the commercially available agronomic varieties. There was some small amount of discussion on whether the use of foreign agronomic species would threaten the existing plant communities but this did not develop as an issue (see Kondla MVPI,Vol. 99 p.15116). The non-industry intervenors did not put forward any expert witnesses on the impacts on vegetation and Justice Berger does not touch on the topic in his report.

Fish:

In relation to fish,discussion developed primarily over stream crossings where there was debate on the effects of pipeline construction as a barrier to migrating fish, and the effects of increased siltation from construction on downstream populations and habitats. There was also some discussion of the effects of methanol discharged into streams after it was used to test completed sections of pipeline. Some of the witnesses appearing for environmental intervenors felt there should be 2 or 3 years more research done to identify sensitive populations. In addition there was some questioning of the best stream crossing techniques. There were also large areas of agreement. Fish experts agreed that the pipeline would not threaten populations as a whole but would rather, at worst, eliminate local concentrations. In addition, all of the fish witnesses preferred the coastal, as opposed to the interior, route of Arctic Gas across the northern Yukon.

Birds:

The northern coast, and especially the Mackenzie Delta, is a major area of bird concentration. In the spring,birds fly down the Mackenzie Valley from the south to nest along the coast and on islands just off the coast. There are also endangered species such as the peregrine falcons which nest along the proposed route (Berger 1977a,p. 44, PAAG 1974). All of the expert biologists who were asked preferred the interior route of Arctic Gas across the northern Yukon.

A controversial aspect of the hearings occurred during the testimony of Gunn, the ornithologist for Arctic Gas, on the cross-delta route. Arctic Gas had decided that its preferred coastal route would not go around the Mackenzie Delta but would instead cross the Delta in a more direct route to link up with the north-south portion of the line. All of the expert witnesses for Arctic Gas, except Gunn, stated that they either preferred the cross-delta route or felt it was of equal impact (MVPI,vol. 133 p. 20175). Dr. Gunn expressed reservations about the route change stating that he felt that going around the Delta was "clearly preferable" (MVPI.vol. 133 p. 20145). Some of the construction across the Delta's channels was to be done in summer, especially that of Shallow Bay. This coincided with the presence of snow geese in the area where they would be feeding to store up energy for their migration south.

This was the only instance where an industry appointed expert witness was clearly critical of his client's proposal. To place this in context, however, Gunn stated that the cross-delta route was acceptable. "I think it's environmentally acceptable with the conditions as they are now" (MVPI,vol. 134 p. 20360).

Whales:

Beluga whales migrate into the Mackenzie Delta region in the summer months. They calve in Shallow Bay in the delta since the Mackenzie River water, which has come from the south, is warmer than that of the sea. The Arctic Gas cross-delta route was to be constructed across Shallow Bay in the summer when the whales were in the area (MVPI,vol. 121 p. 18470). The pipeline was to cross the Bay at a point further south than the area which was thought to be the main calving area. The distribution of the whales in the part of Shallow Bay to be crossed was uncertain,however, and there was to be barge traffic associated with the construction. Sergeant stated that the beluga were sensitive to disturbance while calving, and that disturbance in the area would drive the whales toward the sea and colder waters. This would jeopardize the

calves. He also stated that there were no suitable calving location alternatives for the whales in the Mackenzie region in the form of deep ice-free warm river mouths at that time of the year.
This meant that the disturbance to white whale calving in Shallow Bay would threaten the population as a whole if it continued over time (MVPI, vol. 122 p. 18475). To avoid this disturbance he proposed a sanctuary for whales with a total ban on development and hunting imposed in the area. This argument influenced Berger considerably. He adopted the sanctuary proposal as a recommendation with the alteration that native hunting be maintained (Berger 1977a).

Caribou:

The Porcupine Caribou Herd is one of the last major herds in North America. It numbers 110,000, about 20% of the total barren ground caribou population (Berger 1977a, p. 38). The annual movement of this herd is as follows. In the winter the herd ranges widely over the large mountainous area 300 miles to the south of the coast. In the early spring the caribou move north forming into groups as they travel until they reach the coastal plain by the Beaufort Sea. Here they calve from late May to mid June. After calving the caribou move east along the coast toward the Delta as one main herd. In August this post-calving aggregation of the herd starts to disperse when the caribou move south toward the winter range. In October the animals mate in the mountains. The cycle then repeats itself.

There was more direct conflict between biologists in the caribou debates than in any other part of the biological impact sections of the Inquiry. The biologists testifying for Arctic Gas stated that the coastal route of Arctic Gas was preferred since its winter construction would avoid the spring calving and summer aggregation. Biologists representing environmental interests were against the coastal route because it was associated with calving and the post-calving aggregation of the herd. The differences of opinion among biologists testifying against the pipeline were also great. Some of the specifics of the caribou discussions will be explored in more depth below in chapters 6 and 7. The caribou were very important to Justice Berger's judgement. Berger justifies his rejection of both coastal and interior routes of Arctic Gas to a great extent on the projected impacts to the herd (Berger 1977a, p. xii). Berger also recommended the establishment of a wilderness area to correspond to the range of the herd (Berger 1977a.p. xiii).

IV The Biological Presentations of Organizations

Arctic Gas:

The scale of the industry effort in preparing their cases before the Berger Inquiry was immense. Justice Berger estimates that the cost of studies done by industry on the pipeline was $50 million (Berger 1977b,p. 225). The environmental portion of the Arctic Gas assessment has been estimated by Arctic Gas participants that I interviewed as between 20 and 30 million dollars.[1] Arctic Gas published a 41 volume Biological Report Series made up of the studies done by their consultants in support of their environmental assessment.[2] At the time of the environmental testimony at the Berger Inquiry in the winter of 1975-76 3 to 4 years of research had been completed.

Arctic Gas used consulting firms to conduct their biological research and to help construct their environmental assessment. The heads of these consulting organizations, or of the research programme associated with the pipeline within a consulting firm, appeared as witnesses. Separate firms dealt with vegetation, fish, bird and mammal sections of the research and testimony. Donald Dabbs, Manager, Environmental Division of R. M. Hardy and Associates, testified on vegetation. Dr. Peter McCart, President of Aquatic Environments, testified on fish. Dr. Bill Gunn, President of L. G. L. Ltd., Environmental Research Associates, gave evidence on birds. Mr. R. D. Jackimchuck, President of Renewable Resources Consulting Services Ltd., testified on mammals. Dr. A. W. F. Banfield, Professor of Environmental Studies and Director of the Institute of Urban and Environmental Studies at Brock University was retained to oversee the research and assessment. Also during the cross-Delta phase of the hearings Mr. R. Webb, President of R. Webb Environmental Services Ltd., was called to give evidence on whales. Mr. Webb had done research on whales for industrial concerns who were developing gas fields in the Mackenzie Delta region.[3] In addition Mr. R.A. Hemstock, an engineer by training, and the Director of Environmental Studies and Co-Ordinator for Northern Activities for Arctic Gas, appeared on the environmental panels as a policy witness to explain the company's position on environmental matters.

Foothills:

The research effort of Foothills was quite modest by comparison. Their consultants had only one summer to examine the impact of the pipeline and they confined their studies primarily to the areas where their pipeline route diverged from Arctic Gas. Where there were overlaps of routing they relied on the work of Arctic Gas. Foothills used one consulting firm, Lombard North, to produce research and provide environmental recommendations. The biologists who were involved in these tasks in relation to fish, birds, vegetation, and mammals gave testimony at the Inquiry. Dr. P.H. Whitney, the Project Manager for Lombard North, testified on mammals. Mr. N.G. Kondla testified on vegetation. Dr. W. Hayden gave evidence on fish. Dr. G. Finney testified on birds. In addition Mr. L.W. Boukhout, the Manager of Environmental Affairs for Foothills, appeared at the same time as the biological witnesses as a policy witness. Mr. Boukhout has a masters degree in biology.

The Environment Protection Board:

The competition between Arctic Gas and Foothills was a key force in shaping the biological debates in the Berger Inquiry. The alliances and splits between these business interests over time, along with their commitment to at least presenting a public image of environmental responsibility, created three industry funded sets of environmental representations at the Inquiry, namely, the direct consultants of Arctic Gas and Foothills, as well as the E.P.B.. All of these presentations were better financed than any of the intervenors. They did not always agree on particular issues, with the result that the amount of detailed criticism was greater than it would otherwise have been (see Gamble 1978).

In September 1970 Alberta Gas Trunk Lines formed the Environment Protection Board as an environmental watchdog. A novel aspect of this body was that although it was financed by industry its actions were not directly controlled. The E.P.B. could conduct studies independently and publish reports without editorial interference.

Three of the nine members of the Board were biologists: Dr. N.J. Wilimovsky on fish, Dr. I. McTaggart-Cowan on mammals, and Dr. L. Bliss on vegetation. The E.P.B. was chaired by Carson Templeton, an engineer, with other members representing engineering and social expertise. Research for the E.P.B. was conducted by Interdisciplinary

Systems, a consulting firm associated with Templeton (E. P. B. 1974, vol. 4).

When Alberta Gas Trunk Lines joined Arctic Gas in 1972 the E. P. B. remained in existence but became the responsibility of Arctic Gas. Arctic Gas curbed the independence of the Board in relation to research. Research could be suggested by the E. P. B. but would be contracted for and controlled by Arctic Gas and their consultants (E. P. B. 1973). The E. P. B. still maintained its editorial independence and published a 4 volume assessment of the Arctic Gas proposal which granted the pipeline a qualified approval (E. P. B. 1974). There were however critical elements in their assessment with the E. P. B. members being divided in their evaluations. For example, Dr. Cowan was critical of the coastal and interior routes of Arctic Gas as they crossed the northern Yukon on the grounds that they would harm the Porcupine caribou herd. Dr. Bliss was very supportive of the Arctic Gas application. Arctic Gas decided to cease funding the E. P. B. past its submissions to the Inquiry.

Intervenors:

The Berger Inquiry itself was expensive. The total expenditures of the Inquiry exceeded $5. 3 million (Berger 1977b, p. 230). A large portion of this money, $1, 773, 918 (Berger 1977b) was spent by the Inquiry to fund the intervenors at the Inquiry.

> ...funding was provided by the Government of Canada to the native organizations, the environmental groups, northern municipalities, and northern business, to enable them to participate in the hearings on an equal footing (so far as that might be possible) with the pipeline companies - to enable them to support, challenge, or seek to modify the project. (Berger 1977b p. 225)

This meant that interests other than the proponents of the developments were represented at the hearings and were able to engage in the cross-examination and the calling of witnesses.

All of the major intervenors at the Inquiry did not advance biological evidence. For example, the Council of Yukon Indians, the Northwest Territories Chamber of Commerce, the Northwest Territories Indian Brotherhood, and the Metis Association of the Northwest Territories did not put forward expert biological witnesses, although the two native organizations listed did cross-examine some of the expert biological testimony. The Canadian Arctic Resources Committee (CARC), the Committee for Original People's Entitlement (COPE), and Commission Counsel presented testimony on biological issues.

Canadian Arctic Resources Committee:

The Canadian Arctic Resources Committee is a privately funded organization interested in the arctic and committed to being an independent watchdog over development plans in the arctic (see Keith et al. 1976). CARC suggested the establishment of hearings to consider the implications of a pipeline. The existence of the Berger Inquiry was a major victory for

CARC (CARC 1973, Dosman 1975).

CARC presented two major panels and three individuals as biological witnesses. The most important was the caribou panel (MVPI.vol. 105-6, 110-1) composed of three witnesses: Lent, Calef, and Bergerud. Dr. Lent was an academic from the University of Alaska. Dr. G. Calef was a research scientist with the NWT government but had worked as a resource person for CARC on assignment to COPE. He had also worked for the consulting firm Interdisciplinary Systems before his involvement with CARC. In this job he had done the caribou studies for the E.P.B. . Dr. Bergerud was loosely associated with the University of Victoria and had had a long history of research on caribou. Although these scientists shared a common opposition to pipeline development these scientists had many points of disagreement with each other.

The other CARC panel was on fish and had three biologists: Stein, Walker, and Steigenberger (MVPI.vol. 103-5). All of these biologists had been involved in assessing the problems associated with arctic pipelines for the Fisheries and Marine Service of the Federal Department of the Environment. These scientists had common concerns.

Dr. V. Geist, an academic from the University of Calgary, was called by CARC to give an overview of the biological composition of the northern Yukon (MVPI,vol. 53a). Dr. Geist also contributed to the caribou debates. In addition CARC put forward Dr. Novakowski of the Canadian

Wildlife Service to give testimony on rare and endangered species (MVPI vol. 102). Finally Dr. E. Peterson gave testimony for CARC on potentially sensitive areas along the pipeline route.

Committee for Original Peoples' Entitlement:

The Committee for Original Peoples' Entitlement is a privately funded native organization which has members in the Mackenzie Delta region. It was the only native organization which became involved with expert biological testimony. Other native organizations concentrated on social testimony. There were many links between CARC and COPE in their presentation of biological evidence.

The environmental research funds which were provided by the Inquiry to intervenors were primarily filtered through the Northern Assessment Group (NAG). This research arm was closely associated with CARC but was meant to provide assistance to the other intervenors. This institutional framework provided the opportunity for the establishment of linkages between organizations. For example Dr. D. Pimlott was the head of NAG. Pimlott, a one time chairman of CARC, had done a study for COPE on the Beaufort Sea (1976). Allison, the biological consultant for COPE who attended the hearings and assisted with the preparation of COPE's case had been a graduate student of Pimlott. As mentioned above Calef had been assigned by CARC to assist COPE in a research capacity. In addition Peterson, who appeared as a witness for CARC, had, through

NAG, acted as an advisor for both CARC and COPE. These linkages are indicative of a high degree of compatability of CARC and COPE on environmental matters.

COPE put forward two expert biological submissions at the Inquiry. They called Dr. A.M. Martell, a Research Scientist with the Canadian Wildlife Service, to give an historical overview of the impacts on wildlife in the Mackenzie Delta (MVPI, vol. 120). The major presentation by COPE was a panel of seven witnesses on the impacts of development on wildlife in the Delta and the Beaufort Sea. All of these scientists were from the Department of the Environment. They attempted to give a multifaceted picture of the various components of the marine environment covering the following areas: Percy on oil spills and marine environments, Grainger on marine invertebrates, Barry on birds, Stein on fisheries of the sea and the Delta, Sergeant on whales, Smith on ringed seals, and Stirling on polar bears (MVPI, vol. 121-2). The focus of this testimony was the impact from exploration developments in the sea with particular emphasis on oil spills. Sergeant's presentation on calving in Shallow Bay was more directly related to the impacts of pipeline construction. The evidence on the Beaufort Sea did not become a focus of discussion. This was partly because the industrial intervenors felt it was outside of the mandate of the Inquiry.

The Commission:

The Commission was the third non-industry funded source of biological testimony before the Inquiry. Commission Counsel was directed by Berger to call witnesses if he felt that it was necessary for the completeness of the Inquiry (Berger 1974). Three biological witnesses appeared before the Inquiry in this way: Peet on fisheries (MVPI,vol. 136), Sprague on water quality (MVPI, vol. 135), and Speller on Delta Wildlife (MVPI, vol. 128). Sprague was a academic from the University of Guelph while the other two witnesses were from government.

As I have outlined above, the organization of the discussions in biology was by interest groups. In the next chapter below I investigate this pattern of social organization of the debates as my starting point for an analysis of the disagreements among biologists.

FOOTNOTES

1 Throughout my interviews a precise figure in never mentioned repeatedly as the cost of the Arctic Gas environmental research. This variation is the possible result of different classifications of what is environmental research. Some participants seemed to include some engineering work as part of the environmental research since an effectively engineered pipeline would cause less environmental problems.

2 The publication dates vary from volume 1 in 1973 to volume 41 in 1977.

3 Webb gave evidence for the Delta Producers as well as for Arctic Gas (MVPI vol. 116-7).

4 Stein testified for both CARC and COPE. Stein was included in the CARC population for the purposes of this breakdown on the basis that he testified for CARC first.

CHAPTER 3

THE SOCIAL ORGANIZATION OF EXPERTS IN THE MACKENZIE VALLEY PIPELINE INQUIRY

I Introduction

The study of the influence of interest groups on the control of scientific expertise has been neglected in the literature on conflicting expertise. In this chapter I analyze the social organization of experts in the Mackenzie Valley Pipeline Inquiry, that is, I investigate the structure and consequences of how experts are organized in relation to debates. I argue that interest groups are important in structuring expertise in public controversies. I also demonstrate that the degree of identification of experts with their clients varies with the resources of these organizations. This latter finding challenges the image in the literature of a parallel structure where scientists are reasoned to be equally involved and opposed in public controversies.

In Chapter 1, I argued that the sociology of science, following Kuhn (1970), has concentrated its efforts on the examination of conceptual communities of scientists. That is, communities of scientists are isolated for study according to whether they share a set of conceptual models or work on similar problem areas. In addition, the concept of a community base has been used by some analysts to explain differences of opinion as differences between groups of scientists who adhere to conflicting paradigms or models of the way that science is done (see Kuhn 1970, p. 150).

Robbins and Johnson have applied this difference between conceptual communities idea to the examination of public policy debate by scientists over the harmful effects of low concentrations of lead (1976). They argued that these differences are traceable to a conflict between the traditions in occupational toxicology which emphasize the existence of a safe threshold of exposure and the perspectives of scientists in a broader range of fields including geochemistry, biochemistry, and ecology which question the threshold idea and argue that low levels of lead are harmful (1976, pp. 356-7). The controlling social relationships for Robbins and Johnson in this explanation of this public debate are therefore competing scientific communities. Groups other than scientific communities are not singled out for mediating or controlling roles.

This also seems to be the case with the political interpretation of conflicting experts. Nelkin and Mazur make the argument that scientific reasoning is influenced by external political factors. However, they are not clear on the controlling social relationships. Scientists adopt political perspectives for unstated reasons and these sets of political beliefs help to cohere groups of scientists into opposing factions. Nelkin does, however, describe how industrial interests develop research to support their development plans (Nelkin 1973, 1971). There is some sense then of interest group control of information in relation to industry but the "activist-scientist" (Nelkin 1979, p. 15) who is critical of development is not described by Nelkin as being controlled. Nelkin also mentions that citizen's organizations accept or reject the advice of scientists in accordance with their needs and their perspectives (see especially Nelkin 1975). There is some sifting here of scientific information but she does not consider whether this is extended to the control of scientific debate.

In contrast to the literature, I begin my analysis of the dispute among biologists in the Mackenzie Valley Pipeline Inquiry with a consideration of the organization of scientists as experts by the various interest groups at the Inquiry. Interest groups are prominent in public policy debates involving experts. Salter and Slaco, in a study of six inquiries in Canada, conclude that:

> Few scientists, who were not affiliated with proponent companies, government departments or advocate groups, participated in the inquiries.
> (1980, p. 29)

Industry and government produce expert information to defend their actions and environmental interest groups argue, using experts, against industry and government actions. A sociological analysis of the disagreement between scientists as experts must begin with a consideration of this social organizational base.

The strength of this approach is clearly indicated in the particular instance of the Mackenzie Valley Pipeline Inquiry where there was considerable organizational control of the debates among experts. All of the expert testimony in the formal parts of the Inquiry was presented by some organizational sponsor. Interest groups presented whom they wished to represent them. One Arctic Gas witness described how this was determined within his organization:

> Before anybody went on the stand, like from the industry standpoint, we went through and gave our viewpoints, and it was the lawyers that decided whether or not they wanted to have us as witnesses. It wasn't as if we had to say that we were going to adhere to a certain party line. We gave, (this was three years before the Berger) where we sat down and, I remember mine was ninety pages of transcript, as to what I felt about the whole pipeline, and why, and on the basis of this industry said we would like him as a witness.

Of all the individual researchers and consultants who worked for Arctic Gas, only a few were selected to stand up and testify in front of the Inquiry. This sifting was not limited to industry participants. The environmental intervenors also went out and found appropriate witnesses. For example, here are the comments of one scientist who helped CARC prepare their case:

> I was involved with CARC helping them identify witnesses, and you look for the witness who is going to make the point most effectively that you want to make.

Another scientist who also helped to identify witnesses for intervenors described how in one instance the opinions of a scientist who had been recruited turned out not to be suitable and he was, therefore, dropped as a possible witness:

> ...(the intervenors) were in the position of shopping for people who either had different points of view to present as scientists or would emphasize the point of view of themselves. (An advisor) approached a fellow in Ontario to give some evidence on...(area)...I never read it, but he felt it wasn't the evidence that...(organization)... would want to bring, so he told the chap that he wasn't going to present the evidence, but he encouraged him to present it himself at a community hearing.

The point comes through very clearly that,within the confines of the Mackenzie Valley Pipeline Inquiry, the biological debates among experts were sifted and molded by the organizations who sponsored the testimony of experts. It should be noted here that there were some people who presented themselves independently as experts, mostly on social matters, in the community hearings. However, the overwhelming majority of expert "scientific" testimony was channeled through the organizational participants in the formal hearings. This was especially true in relation to the natural sciences.

The importance of interest groups for structuring expert debate can be extended beyond the particular case in point but this must be interrelated with other social organizational factors. It may be, as Robbins and Johnson suggest, that in the lead issue the differences among scientists are the result of a conflict between two scientific communities. However, to pursue this example, in any particular discussion about the effects of low-level lead in an affected community, interested citizens groups may evolve and structure the debate by drawing upon scientific advice in a selective way (for this development in Toronto see Lax 1979). In this way the dispute between scientific communities can be mediated by the interests of lay organizations in particular discussions. The extent to which lay or scientific groups structure a debate will depend therefore on a variety of factors, including the extent to which relevant scientific communities are mobilized in relation to the issue at hand. For example, Gilpin (1962) has argued that atomic scientists after World War II had an increasing sense of social responsibility for the nuclear weapons which were an extension of their craft. This caused them to actively participate in public policy discussions independently of their being organized by interest groups to do so.

In the biological discussions in the Berger Inquiry the lay organizations played a major role. This was perhaps facilitated by the fragmentation of the biological case into sub-disciplines within biology. The biologists who gave testimony were specialists in the different areas of plants, land mammals, marine mammals, fish, and birds. These specialities were sometimes further divided on a species basis.

Scientists who were part of these various scientific communities were distributed among the organizations. For example,the three botanists were distributed over three organizations. The various organizations pieced together their presentations by drawing upon scientists over a wide range of disciplines. The groups which co-ordinated these disparate scientists were the interest groups. However, the point that the various organizations were important for the structuring of debate is only the beginning of the present analysis. I take the argument one step further and propose that the structure and resources of the various organizations created different patterns in the social organization of expertise.

II The Organizational Integration of Experts

In this section the degree of integration of scientific witnesses with their organizational sponsors is examined. It is shown that industry participants were far more able to integrate their scientists than were intervenors. This difference is related to the varying resources and organizational patterns among groups. These factors resulted in varying degrees of control over their scientific witnesses.

The analysis of integration presented here has objective and subjective dimensions. Objectively, the general structural patterns of each organization are discussed. Subjectively, the meaning of the relationships within the organization for participants is examined.

This latter concern follows from the assertion in the first chapter that the subjective meaning which events have for participants is important to understand, since action is structured and made possible by this meaning. These subjective factors are studied primarily through an analysis of participants' replies to the question "What do you think of (affiliated organization)'s impact assessment and input into the Inquiry?".

In this way participants' attitudes towards their organizations and the extent to which they identify with their sponsor is explored. Replies to the main question were supplemented by comments which participants made at other points in the interview about their sponsors and their relationships with them. Commission associated participants differ from the others with respect to the central interview questions which were used to assess their views. These participants were not asked the above main question. This was so because there were other questions in the interview schedule which addressed the Inquiry and the environmental case of the Commission. It was primarily from these other questions that the Commission participants'views were assessed.

Participants' comments are coded as positive, negative, mixed, and do not know. Positive indicates comments which are strongly supportive. Negative reflects comments which are clearly derogatory. Mixed denotes a combination of positive and negative remarks. Do not know signifies that a participant was not sufficiently familiar with his organizational sponsor to make a comment. The criteria which were used in placing participants' comments into these classifications are subjective. The validity of the classification decisions is demonstrated by the illustrative quotations which are included in the narrative. This classification of scientists' views is summarized in Table 1.

In what follows, each organization is discussed in turn in relation to the integration of scientific participants. This survey is concluded with a general analysis of integration.

III The Integration of Arctic Gas Scientists

Arctic Gas participants both lay and expert were the only group of respondents with uniformly positive comments on their organization (see Table 1).

In all of the comments by Arctic Gas witnesses on the Arctic Gas assessment there never arose any distinction between their and the company positions. The identity of the consultant and sponsor position is perhaps best illustrated by one witness' description of this relationship:

> Now you've got to realize that these experts were hired by the clients and worked for four or five years to solve the problems. It's not necessarily that they were agreeing with their clients but that they were agreeing with themselves...I'm not going to get up there and say you know well the client is obviously full of shit because in fact I am his advisor on that particular aspect of his application...so really what I'm saying is I know what I'm talking about and I'm going to defend myself.

TABLE 1

Scientists' Evaluations of
their own Organizational Sponsor*

Scientists by Organization

Evaluations	Arctic Gas	Foothills	E. P. B.	CARC	COPE	Comm.
Positive	6	3	1	1	2	1
Mixed		1	1	2	1	1
Negative				1		
Do not know					2	
TOTALS	6(6)#	4(4)	2(2)	4(4)	5(5)	2(2)

*Based primarily on responses to the question:

"What do you think of (affiliated organization)'s impact assessment and input into the Inquiry?"

the number in brackets is the total sample size

The witnesses emphasized the research they had done in support of the application. For example here are the comments of one witness:

> To me the value of the statement is the Biological Report Series which stands behind it.

Or more forcefully by another witness:

> Well I can tell you it was probably the most comprehensive environmental study that was ever carried out...

These comments were paralleled by the lay Arctic Gas participants who described their environmental case in glowing terms. Lay Arctic Gas participants emphasized the high quality of the consultants and the scientific work which had been done in support of the assessment. Here are some of the comments of one lay participant on this last point:

> It was based on scientific data. All the conclusions were supported on a scientific basis.

The Arctic Gas consultants varied greatly in professional experience and former occupations.[1] None of them had been consultants for very long before their association with Arctic Gas. This was in part a reflection of the newness of the environmental consulting industry. In addition none of them had worked together before their involvement with their client. Their cohesive and sympathetic view of their sponsor is a reflection, therefore, not of a uniform background but of their careful selection and the long term working relationships which they developed with the company. One lay Arctic Gas participant stated that the scientists who worked for Arctic Gas were at first suspicious of their sponsor:

> There was this tremendous polarization. It was we against them, and it didn't start that way in that our witnesses, as I mentioned earlier, our consultants started out being very leery of us, but as soon as they were associated with the pipeline and doing research, immediately they became branded as bought out by industry and would do anything to get the results that they wanted and on and on, and I think that that was definitely not the case but that's the way it was perceived by most of their peer group, and as a result they became a little defensive and became very pro.

There is no trace of distrust or suspicion in the Arctic Gas witnesses' comments. The issue of conflict and polarization within the hearings is developed later on in the thesis. It is enough to confirm at this point that Arctic Gas scientists did very clearly identify with their sponsor.

In summary then Arctic Gas participants exhibited complete unanimity in their positive attitudes towards the environmental case of Arctic Gas. It suggests that this is the result at least in part of their long standing association with the company in a co-operative problem-solving work environment. This work situation is dependent on the resources available to Arctic Gas in that they were able to recruit and focus the energies of these people for a considerable length of time. The strength of this interpretation is demonstrated in the comparisons with the organizational evaluations of other participants below.

IV The Integration of Foothills Scientists

Foothills participants,like Arctic Gas participants,exhibited a high degree of positive organizational assessments with only one scientist making a mixed remark (see Table 1). Unlike the comments by experts testifying on behalf of Arctic Gas, all of the comments by Foothills witnesses referred to some form of distance between themselves and their organizational sponsor. For example,one witness praised Foothills for their handling of witnesses. He does, however, refer to an apprehension on the part of witnesses about testifying on behalf of the company:

> I thought they handled us as witnesses pretty damn well... We went up there very, very apprehensive, all of the people with the company I was with, we were apprehensive about testifying, and we would appear to be owned by Foothills and strongly biased in that direction. And they made it very easy for us not to feel that way. They told us to testify as we thought best. If we seriously disagreed with or thought that Foothills' proposal was going to do substantial damage to anything all they really wanted to know is, they wanted to know before we testified that on the stand. Now what would have happened, if they would have pulled us off as witnesses, I'm not at all sure. But I have a feeling that they probably wouldn't have.

This distance was also evident in the comments of a second witness,who after making positive comments concerning the Foothills work,alluded to pressures which he felt being exerted upon him:

> On the whole I don't think the witnesses were as supportive of the company positions as one might think just by reading the testimony...the message came across to me quite clearly that it would not be desirable to speak unfavourably of the impact of the Foothills project in public...
> On a more positive note, since most people realize that this sort of stuff goes on, I would like to think that if you maintain a liaison with a client, and maintain some level of credibility, that you can influence things further down the road, and make a positive impact, and that's not a motherhood statement, I honestly believe that.

This witness had made a tradeoff, continued association and possible influence over the long term in exchange for a compromise in the short. The third witness also referred to a difference between his perspective and that of the sponsor but he indicated how this difference was overcome by his change of mind:

> I would say that I was probably in a classic liberal mode which one would expect in graduate school at university. I would say that my attitudes came around or changed rather rapidly in the two or three months that I was involved with the company prior to going into the field... I became. Oh you just have to face head on the practical problems, and you have to look at the world, even from environmentally, you have to look at it realistically rather than strictly idealistically.

This witness ended up with strong positive comments on the quality of the Foothills assessment:

> I thought we did a good job...not even for the amount of time. I think we did a good job period. ...We were trying to take it from a baseline inventory type information to specifically how the line is going to affect that...environment and what you are going to do about it. I think we were probably further ahead than Arctic Gas was.

From all three of these witnesses there was some form of distance referred to as existing between them and their organizational sponsor. In the first case apprehensions were dispelled. In the second conflict was resolved by the compromise of the scientist. In the third differences in outlook were eliminated by the rapid conversion of the witness to a perspective more suitable to his consulting relationship.

This distance between scientists and their sponsor organization is possibly a reflection of the short time they were associated with Foothills. These witnesses were only involved with the project for between 3 and 8 months before they appeared as witnesses at the Inquiry in December of 1975. In addition, they did not remain associated with Foothills since the specific proposal which they were charged with assessing, the Maple Leaf Line down the Mackenzie Valley, ended up being dropped by the company in favour of the Alaska Highway alternative. These witnesses were not reassigned to this new project. In one case at least the witness left the employ of Foothills before the termination of the hearings.

Like Arctic Gas, Foothills could not rely on the common background of scientists. Their witnesses had different educational levels, attended different universities, were from various specialities within biology, and had different work experiences.[2] Unlike Arctic Gas

Foothills did not have the time to fully integrate these scientists into their organization or to weed out unsuitable elements. This is reflected in the comments of these scientists on their organization.

Further evidence of this relationship is provided by the biological advisor. This person did make the transition between Foothills' projects and maintained a relatively long standing relationship with the company. His comments on the relationship between consultants and their sponsor parallel the comments of Arctic Gas scientists.

> The proponents' position on the environment was the result of their scientists' assessment and not necessarily vice versa.

This Foothills scientist with the enduring association with the company betrays no tension between scientific advisors and their clients.

Like Arctic Gas lay participants,Foothills lay participants were positive about their organization's environmental contributions. One lay participant stated that their presentation was excellent considering the time and the money available. Another lay person pointed to the lack of waste in the Foothills effort since they did not duplicate work which had already been done by Arctic Gas. As in the case of Arctic Gas these positive comments indicate that the organization enjoyed a degree of internal unanimity when it came to the environmental testimony.

The major differences between Arctic Gas and Foothills, with respect to their ability to integrate scientific witnesses,was therefore time. The lack of time for Foothills is reflected in the distance which witnesses recognized as existing to various degrees between themselves and the organization. However in two of the three interview instances this distance was resolved in an unambiguously positive way. In addition the scientist with the longer term of association with the company was shown to exhibit none of this tension. In this way the strength of the forces of integration operating within the industrial consulting relationship are demonstrated.

V The Integration of E. P. B. Scientists

The E. P. B. was split in its assessment of the Arctic Gas application. One of the witnesses who was interviewed had a pro Arctic Gas stance whereas the other witness and the organization person were less favourable toward the Arctic Gas project (see chapter 4 below). These conflicting assessments are paralleled in two cases by critical comments of their opposition within the Board. It is argued below that there are good organizational reasons for this internal division.

The E. P. B. participants all had positive things to say about the idea of an independent assessment board. Two of these participants qualified this approval with critical comments on specific participants on the Board. The pro Arctic Gas witness, for example, stated that the E. P. B.

had a major role to play but that the Inquiry ignored it in the final decision making. This participant went on to criticize the performance of another E.P.B. witness as politically biased. This participant related how this other witness had testified that a certain area was crucial to a particular species and that the pipeline route should avoid it. Immediately after this testimony the pro Arctic Gas witness stated that he confronted this other witness with his assertions and had him agree, off the record, that the project would be harmless:

> I said in the final analysis you're saying that if government and industry do this right the amount of impact on that (animal population) is going to be very low. He says that's right. I said then why don't you get back on the witness stand and tell Berger that. And he says because that's not our motivation here. In other words here is a respected biologist who listening to the scientific information could say that the scientific data we had in hand indicated that this can be handled in a manner that is not going to lead to disaster but preferred politically to present a case leaving the implication that it would lead to biological disaster.

This participant further went on to criticize some of the staff scientists who conducted studies for the Board and who didn't want to say that the pipeline could be built:

> Our own biologists within the Environment Protection Board, from the data base that they had, had to admit that a pipeline could be built in a manner that would not be environmentally devastating as long as certain terms and conditions were imposed. But they didn't want to say that. They didn't want to say it because they had the psychological hangup of not wanting to admit that something could be done...

In addition this participant outlined how a faction within the Board had attempted to use the reputation of the Board to further its own causes and that he, and others on the Board, had to ensure that the E.P.B. was disbanded as soon as its legitimate business had transpired so that this wouldn't occur.

The organization person interviewed was on the opposite side of the fence in this internal conflict. This person indicated that two of the Board witnesses had changed their opinion because their interests were tied to industrial contracts:

> Respondent: Well we ran into some difficulties in the Board in the last, during the last testimony, and with what it didn't have to do with some of the funding of research.
>
> Interviewer: Have to do with what?
>
> Respondent: Funding of research. You see some of the members had fairly sizable research projects for industry and the arctic petroleum operators were funding some of them pretty heavily. In particular the last switch in the testimony of...

The witness and the lay person quoted above were both classified as making mixed comments as a result of their positive comments on the E.P.B. in general.

The E.P.B. had a different organizational form than the other industry funded submissions. The witnesses who appeared for the E.P.B. were members of the E.P.B. and as members were not full-time employees of the Board. They met to consider the studies which the staff retained by the Board had produced on their direction. In addition they co-operated in the writing of the recommendations of the Board. They did not, however, dedicate themselves in a co-operative work environment on a full-time basis to produce an assessment of the Arctic Gas application. All three of the biologists on the Board were academics with other organizational commitments.[3]

This fragmentation of energies within the Board was cross-cut by the shifting sponsorship of the Board. Carson Templeton, the originator of the Board, had been asked by Bob Blair the President of Trunk Line (and later Foothills) to conduct environmental assessment of the projects which would develop. This resulted in the formation of the E.P.B. . The merger of Trunk Line with Arctic Gas brought the E.P.B. under a new sponsorship arrangement where their autonomy and jurisdiction were curtailed. This relationship, like that of Trunk Line within Arctic Gas, was an uneasy one (see chapter 4 below). This is reflected in the comments of the lay person on some of the witnesses for the Board with opinions favourable to Arctic Gas. The Board was the first group to be formed which would eventually present evidence at the Inquiry. Board witnesses' associations extend through time at least as long as Arctic Gas witnesses. This highlights the importance of the organizational pattern and not just the length of association in the analysis of the integration of scientists. Unlike Arctic Gas and Foothills consultants, the E.P.B. witnesses all had major interests in areas outside of the Board. They did not develop a common perspective partly because they were not developing and articulating their ideas in relation to a common experience. The common experience of the Foothills witnesses, despite the short length of time, produced a greater degree of integration. Also, the shifting sponsorship of the E.P.B. blurred the purpose of the Board and this affected the suitability of the witnesses who were selected. The witnesses for the E.P.B. were not selected by someone who was appointed by Arctic Gas. They had been chosen by someone who had been associated with Trunk Line and for a different project. In this way the selection procedures were less effective, from the sponsor's point of view, in developing witnesses with a perspective favourable to the project. In addition, the shifting sponsorship and the curtailment of the Board's activities translated into a conflict over allegiances within the Board, providing a further source of internal tension.

VI The Integration of CARC Scientists

Of the four CARC witnesses who were interviewed, only one made a clearly positive remark on his organization. One witness was classified as making a negative remark since he referred to CARC as "not credible" and two witnesses made mixed comments. Here are some of the comments of one of the witnesses with a mixed remark who had an intimate association with the development of CARC's case:

> I was not at all impressed with CARC's total input at the Inquiry. I have exceptionally high regard for CARC and its capabilities and its people. The Northern Assessment Group, however, which is the body that CARC created to do this work for it was a disaster. ... They simply had trouble mobilizing, and again I think a lot of it was attributed to (an organizational person's) difficulties at motivating and motivating the whole force. ... Until very late in the procedure money was spent in the wrong place. Too great a proportion of their budget was spent in research, in quotes, researching information that need not have been researched, and they were too late in cultivating the resident knowledge that existed already in 50 or more government scientists who had been working for 4 years on the Mackenzie Valley in various government departments and were some of the most knowledgeable people in the whole area and were not going to be tapped unless someone like CARC tapped them as witnesses.

It is clear from these remarks that agreement with the environmental position of CARC does not necessarily equal unanimous agreement with the way the organization conducted itself at the Inquiry. This can in part be related to the type of umbrella organization which CARC was, encompassing various viewpoints, so that in principle CARC would not necessarily be unified in its views. The structural underpinning to this diversity was the lack of resources. Scarce resources made it necessary to unify various viewpoints since several independent cases could not be pursued at the same time, Further, scarce resources highlighted conflicts within the organization. There was not enough surplus to develop various lines of attack at the same time so as to accommodate different approaches.

Another important point which surfaces in the remark quoted above is the conflict between environmental groups and some scientists associated with government. The scientist who is being quoted was a senior government scientist who had been involved with the internal government studies on the impact of pipeline development in the Mackenzie Valley. For this person there already existed a considerable body of expertise within government. It appears that at first this was not recognized by some of the figures in CARC. Further, there was a distrust on the part of some within CARC on the quality of the information produced within government (see for example Pimlott et al. 1976). Government scientists were also uncomfortable with the environment interest group approach to the hearings. This was evident in the remarks of the witness with mixed comments. This witness stated that CARC tended to "carry the torch" for social causes and mixed environmental with social issues. It is also clear, however, that this scientist agreed with this mixing.

> It's partly a criticism and they, to give the devil's due... I was...asked by the counsel for the Canadian Arctic Resources Committee not to mention the social issues, the social aspects at all, strictly the science, and I did so, although I was sorely tempted to go the other way.

Other tensions between government scientists and CARC are related below in chapter 4. It is instructive to note at this point that the three witnesses with mixed or negative comments on CARC were associated with government,while the witness with the positive comment was not.

CARC had to rely on scientists who were oriented toward other organizations, mostly government. Six of the nine CARC biological witnesses were associated with government.[4] If CARC and COPE presentations are combined, of the total of 16 witnesses in biology, 13 were from government.

CARC had the highest profile of any participating environmental organization at the hearings. Formally, this was recognized by the Commission when CARC was assigned by the Commission to provide assistance to other intervenors in environmental matters through an organization called the Northern Assessment Group (NAG).
This organizational link helped to blur the case of CARC and COPE. Personnel made the migration between organizations via NAG.[5]
This formal role for CARC suggests that there was a high expectation, by critical participants, placed on CARC's involvement. This expectation, and their disappointment with CARC's performance, is repeatedly mentioned by those intimately involved in the environmental testimony (see chapter 4 below). It is also reflected in the two mixed comments by CARC organization persons. Here are some of the comments from one of the central organizational figures in CARC who made mixed remarks:

> We were ourselves disappointed in that it was a much more difficult thing to, to develop evidence, and prepare witnesses than I guess we had first thought.

Another organization person who was involved in a major way with the development of CARC's case also pointed to these difficulties:

> ...with an ad hoc inquiry...you don't have the time to gear up and therefore a lot of mistakes were made as to the type of research and the people who should be doing it and so on...you try to put a team together in a hurry and get them to be effective so that to that extent there was some disappointment that maybe we weren't quite as efficient as we could have been...

In summary, the lack of resources available to CARC is reflected in the lack of unity within the organization. Four major points emerge in this respect. First, scarce resources contributed to the coalescence of various perspectives within one organization. Second, the lack of resources meant that conflicts over the best way to dispose of scarce time and manpower could surface and not be drowned in a broad effort on a variety of fronts. Third, lack of resources made it difficult for CARC to cultivate and assimilate scientists to their point of view. Notable in this respect are the attitudes of some government associated scientists who were not comfortable with the patterns of interaction characteristic of a public pressure group. Fourth, the high environmental profile of CARC, and the high expectation which went along with the official recognition of its environmental role, meant that organizational shortfalls were met with criticism (see chapter 4 below).

VII The Integration of COPE Scientists

The environmental intervenors lacked the resources and the time to cultivate their own scientific witnesses. As a result,the variation of purposes and perspectives within these organizations is marked and contrasts with the two proponents. In the case of COPE this is indicated by a considerable lack of identification with COPE on the part of witnesses.

The most striking indication of the distance between some witnesses and their organizations is the comments of two of the witnesses who appeared for COPE where they indicated that they were not familiar with COPE. For example one of these witnesses consistently stated that he did not know enough to make comments about any of the other organizations which made representations at the Inquiry (see chapter 4 below). This person extended this lack of knowledge to COPE:

> As far as COPE was concerned I felt no relationship to COPE and I wouldn't categorize or think differently of COPE than I would of any of the other groups.

These two respondents were coded as making "do not know" remarks. In addition the witness for COPE who made essentially positive comments directed these toward the testimony of the panel of which he was a part, and not toward the organization which sponsored him. The organization did not have a role in his comments. The witness with the mixed comments states that COPE were "sharp cookies." but that most of their advisors, with the exception of one biologist, were "extreme". Therefore, all of the witnesses for COPE who were interviewed indicated in some way a lack of identification with their sponsor. COPE biological witnesses were all from the Department of Environment.[6] All of these scientists had very short relationships with their sponsor, and in no case was the information which they presented produced for COPE. In the case of Barry,he was attached to the Commission and was exposed therefore to COPE and their case in this position. In this sense he was far more familiar with the organization than the other witnesses. His involvement with COPE as a witness was, however, brief like the other and lasted for only a few days. His being called as a witness for COPE is an indication of the compatibility of the Commission with the environmental intervenors.

The indifference to COPE which is clearly evident in 3 of the 4 COPE witnesses who were interviewed reflects the lack of involvement of these witnesses with their sponsor. This lack of integration has structural roots in the restricted resources of COPE, which could not develop and cultivate its own scientific expertise. The indifference of witnesses could also reflect the low environmental profile of COPE. COPE as an organization was primarily concerned with the situation of native peoples. The participants I interviewed only recommended that I talk to the lawyer for COPE and his advisors in biology.

VIII The Integration of Commission Scientists

Unlike the other non-industry organizations the Commission itself had considerable financial and organizational resources. The Inquiry retained a staff of biological advisors from government, and these people assisted the Inquiry in sifting the testimony. However the witnesses who appeared for the Commission were not drawn from this group of scientists and had very short periods of association with the Inquiry. The Commission presented three witnesses in biology.[7] The Commission witnesses who were interviewed recounted how they had been in touch with the Inquiry only for several days.

The remarks of Commission witnesses on the Commission were fairly positive. One witness was classified as making positive remarks while the other was classified as making mixed comments. The mixed witness made generally favourable remarks but when describing his relationship to the Commission pointed to pressures exerted by Commission Counsel to have him say things which he was not prepared to say:

> ...during the Inquiry they had problems with me in that they were coaching me.... then they got into the however "we would like you to elaborate on this point and this point", you know this was for their purposes because I was being called for crown counsel, and some things there I wouldn't do, they would like to draw out of me. Like every biologist, the data is not hard, and there is a certain interpretation, and you know the way they do it is "would you interpret it this way?" or "could you have an alternate interpretation?" meaning that we want you to say that. I just said "look this is what I'm going to say".... There was no attempt to make you say something that wasn't there but given your testimony, and they read it, they wanted me to elaborate on certain points...

These comments reflects a lack of integration on the part of this witness with his sponsor. In my view, this is founded on the very brief relationship which this witness had with his sponsor. In contrast, all of the Commission organization participants were very positive about their organization, reflecting the long term co-operative situation which they experienced within the Commission.

In summary, the Commission selected witnesses who were compatible with the purposes and findings of the Commission. This is reflected in the generally positive remarks by witnesses on the Inquiry (for more detail see chapter 5). However like most of the intervenor witnesses those for the Commission had only brief relationships with their sponsor. This brevity is made clear in the tension which was experienced between the Commission and one witness over his testimony.

IX Summary Discussion

There has been a neglect in the literature of the consideration of the influence of interest groups on debates among scientists as experts. The information presented in this chapter demonstrates the importance of interest groups in structuring the debates in the case of the Mackenzie Valley Pipeline Inquiry. Organizations controlled the flow of expert information at the Inquiry. The prominence of interest groups in this particular case points to the importance of the consideration of interest groups in the analysis of conflicting expertise in general. The centrality of this topic is clear in the many cases involving public policy debates where experts are presented by contending interest groups.
However, this basic point concerning the social organization of expertise is only the beginning of social enquiry in the present study. The task I have undertaken is to understand in what way this pattern of organization affects debaters.

Robbins and Johnson (1976) argue that differences between scientists in the case of lead are a conflict between two scientific communities with different standards of scientific practice.
Their approach continues in the tradition of the sociology of science, following Kuhn (1970), which isolates groups of scientists for study

according to the extent to which they share sets of conceptual models, and further, explains wide ranging difference of opinion between groups of scientists as based in the adherence to competing conceptual models of science. I am in general agreement with this tradition (see chapter one); however, the importance of interest groups for the structuring of expert debate introduces a social organizational base, other than scientific communities, for the analysis of conflicting expertise. If interest groups structure expert debate, then the role of conceptual communities must be appreciated in terms of this mediation. In the particular case of the debaters in the Mackenzie Valley Pipeline Inquiry, I have argued that there was no disciplinary division in biology upon which interest groups drew for their expertise. Scientists were recruited from a wide variety of disciplines to correspond to the various areas of concern to the Inquiry debaters. The division of scientists into a broader conceptual division within arctic biology will be explored in chapter 9.

I argue above that the degree to which scientists had become integrated with their organizational sponsor varies among organizations at the Inquiry. Scientists associated with the two industry proponents were more integrated with their sponsors than were the other scientists with their sponsors. It was suggested that this high degree of cohesion was at least in part the result of the selection procedures of industry participants along with the co-operative problem-solving working relationships most industry scientists experienced with their sponsors. Time was also seen to be an important factor. Foothills witnesses, who all had brief associations with Foothills, demonstrated a distance from their sponsors not present in the Arctic Gas witnesses. Nevertheless, the great degree of social cohesion exhibited by even Foothills participants provides evidence for the integrating forces present in the industrial consulting relationship. The considerable resources of the industrial proponents meant that these organizations could employ scientific personnel so that a major focus of their time would be the project and its problems. This facilitated the integration of scientists within the folds of the organization. Evidence for the adaptive pressures of this relationship for scientists was clearly displayed in the comments of Foothills witnesses where they all demonstrated how they adapted to their role as advisors to an industrial proponent. Foothills witnesses were reassured by their sponsor's actions, converted to their sponsor's point of view, or compromised their ideas for continued association. The distance which one Arctic Gas lay person alluded to as existing at one time between Arctic Gas scientists and their sponsor had long since disappeared.

The social organization of scientists as experts and how this relates to group cohesion is complex. Time, which in the case of

Arctic Gas appeared to create cohesion has in the case of the E. P. B. sown dissension. A confusion of mandate, strained relationships with a new sponsor, and the different allegiances of the Board members contributed to vigorous internal conflict.

The differences in resources available to organizations and its consequences for the integration of scientific personnel.were exhibited clearly in the contrast between the industrial proponents and the two interest group intervenors, CARC and COPE. Both CARC and COPE had relatively meager resources and this meant that they were unable to provide a situation where their witnesses could develop testimony for the Inquiry under the influence of these organizations. These intervenors relied primarily on scientists who had already established views. In this way the process of selection was very important to these organizations in the development of their scientific testimony. In arguing for the importance of resources to the relative integration of scientists it is assumed that the various groups, given the same resources, would have behaved in a similar way with respect to the creation of research. Given the availability of 20 million dollars to develop a case CARC might have engaged in intensive research as did Arctic Gas. Evidence for this is provided by CARC which, with the resources it did possess, tried, and failed to create its own information through the Northern Assessment Group. It is likely that CARC, if it had had resources similar to Arctic

Gas, would not have relied on government scientists to the extent that it did. This would have reduced the conflicts between CARC and some of these government scientists. Scarce resources also were a cause of conflict within these organizations since the allotment of resources could become a focus of debate with everyone not being able to pursue their preferred course of action. Whatever the particular differences in the social organization of experts, the fact remains that scientists varied in their integration with their sponsors.

The theoretical importance of these findings relates to an issue other than the social organizational focus of analysis. The literature on conflicting expertise creates an impression that there is a parallel structure in expert debates. Scientists are characterized as polarized, that is equally and oppositely committed to positions in the debate. This is the case whether writers emphasize the political component of scientists' attitudes (for example Mazur 1973, Gilpin 1962) or the differences between disciplines (Robbins and Johnson 1976). The evidence in this chapter, on the identification of scientists with their sponsors, suggests that, on a social level, scientists were not parallel. Scientists were not equally involved, in organizational terms, in the biological debates in the Berger Inquiry. This lack of parallel structure is pursued in the next chapter in relation to the patterns of conflict within the Inquiry.

FOOTNOTES

1 The Arctic Gas studies on the environment began in 1971. All of the witnesses, except one, worked for Arctic Gas from that time. This association continued until 1977 when the project was abandoned. One witness, Webb, was brought in to give testimony on whales in the Delta phase of the Inquiry (MVPI vol. 116 p. 17643). He had worked as a consultant to the oil and gas industry on whales in the Mackenzie Delta, and it was on the basis of this work that he was called as a witness.

The backgrounds of the main Arctic Gas consultants were quite diverse. Banfield, the person who was in charge of the overall design of the research, is a senior member of the Canadian biological community. He had been with the National Museum of Natural Sciences between 1957 and 1968 first as chief zoologist and then as director. Banfield has a doctorate in zoology (Michigan 1952) and has published widely. His main arctic work was on caribou where he pioneered the use of aerial population survey techniques. At the time of the Inquiry he was an academic at Brock University (MVPI vol. 51 p. 6772). Dabbs, the botanist, had a masters degree in plant ecology (Saskatchewan 1971) and had worked for the Canadian Wildlife Service between 1968 and 1970 before he entered consulting work. He was the first consultant to be retained by Arctic Gas in biology. Gunn, the bird specialist, has a Ph. D. in zoology (Toronto 1951) and was associated with the Ontario Federation of Naturalists and had been a biological consultant to the Canadian Broadcasting Corporation's television show "Nature of Things". He began a consulting firm in 1970. McCart, the fish specialist, has a Ph. D. (British Columbia 1970) and had been a researcher for the Fisheries Research Board in British Columbia between 1963 and 1968. At the time of the beginning of his involvement with Arctic Gas he was an academic at the University of Calgary. Finally Jakimchuck, the mammals specialist, had a bachelors degree in zoology from the University of British Columbia. He had started Renewable Resources, an environmental consulting firm, in 1968 being one of the first in the field. Before his consulting he had worked for government between 1964 and 1968 in land classification work.

2 Like Arctic Gas the Foothills witnesses came from diverse backgrounds. Finney on birds had just finished a Ph. D. (Queens 1975) and took his first regular position with Lombard North, the Foothills environmental consultant. Whitney on mammals had a doctorate from the University of Alaska at the Institute of Arctic Biology (Alaska 1972). He had been at the University of Calgary on a post-doctoral fellowship for 2 years before he was employed by Aquatic Environments, the fish consultant to Arctic Gas for one year. In this position he had supervised research on a variety of projects. Hayden, the fish witness, had a masters degree (Alberta 1971) and had worked with various governments as a biologist until he joined Lombard North to consult on the Foothills project in May of 1975. Finally Kondla had a bachelors degree in botany and zoology and had worked for Lombard North for 2 years before being assigned to the botanical research on the Foothills project.

3 Dr. Bliss, the botanist, was a professor of Botany at the University of Alberta and the director of an environmental facility there. Bliss also had been the director of a five year study of the ecosystem of an island in the arctic during the time which he was associated with the Board. In addition he had engaged in some consulting to oil companies (MVPI, vol. 46 p. 6003). Dr. McTaggart-Cowan, on mammals and birds, was a professor of zoology at the University of British Columbia and the dean of the Faculty of Graduate Studies there. McTaggart-Cowan was associated with numerous advisory bodies and environmental organizations (MVPI, vol. 46 p. 6009). Dr. Wilimovsky was a professor in the Faculty of Graduate Studies in the Institute of Resource Ecology at the University of British Columbia. Wilimovsky, like McTaggart-Cowan, was on a wide range of advisory bodies (MVPI, vol. 46 p. 6015).

4 Steigenberger, Walker, and Stein, who appeared as a panel on fish had all been associated with the Fisheries and Marine Service of the Department of the Environment, and had conducted studies on pipeline development for the internal government Task Force on Northern Oil Development. Dr. E.B. Peterson, the overall co-ordinator of these studies, gave testimony on their general findings. The remaining government scientists were Dr. N. Novakowski on endangered species and Dr. G. Calef on caribou. The remaining three scientists were academics. Dr. T. Bergerud and Dr. P. Lent, of the University of Victoria and the University of Alaska respectively, gave evidence on caribou.
Dr. V. Geist of the University of Calgary testified on arctic environments and also participated in the caribou debate.

5 For example, Calef, who had done the caribou studies for the E.P.B. was hired by NAG to be attached to COPE as a biological advisor. Also Peterson, a witness for CARC, worked for both CARC and COPE as an advisor while he was attached to NAG. In addition Dr. Douglas Pimlott, the second director of NAG had been a resource person for COPE and had developed a general study of the Beaufort Sea and oil exploration for them (Pimlott et al. 1976). Pimlott had also acted as chairman for CARC.

6 COPE biological witnesses were all from the Department of the Environment. Dr. J. A. Percy on oil spills, Dr. E.H. Grainger on biological productivity in the Beaufort Sea, Dr. D.E. Sergeant on whales, and Dr. T.G. Smith on ringed seals, were all from the Arctic Biological Station in Ste. Anne de Bellevue, Quebec. On the same panel with these scientists were Dr. T.W. Barry, Dr. I. Stirling, and Mr. J.N. Stein. Barry, on birds, was with the Department of the Environment but, at the time of his testimony, was assigned to the Commission as a biological advisor. Stirling, who was the witness on polar bears, worked out of Edmonton for the Department of Environment. Stein, who testified on fish, was with the Fisheries and Marine Service in Winnipeg. Stein also appeared for CARC and for the purposes of this study was classified as a CARC witness since he appeared for CARC first. The only other biological witness, Dr. A.M. Martell, who was stationed at Sault Saint Marie, gave evidence independently on the history of man's impact on wildlife in the Mackenzie Region.

7 Dr. W. Speller, from the Department of Indian and Northern Affiars, gave evidence on the accumulated impact of developments in the Mackenzie Delta on wildlife. Dr. Peet, head of the Fishery Management Division, gave evidence on fish. Finally Dr. Sprague, an academic from the University of Guelph, testified on water quality.

CHAPTER 4

THE SUBJECTIVE DIMENSIONS OF CONFLICT (I): PARTICIPANTS' EVALUATIONS OF OTHER PARTICIPANTS

I Introduction

This Chapter discusses the conflicts between organizations within the Inquiry. I argue that participants affiliated with different organizations did not have similar interaction experiences within the Inquiry. I show that conflict is not always reciprocal; that is, it is not always recognized in the same way by various sides.

The literature on conflicts among experts outlines a situation within which conflict has a parallel structure. For example, Gilpin, in his analysis of the test ban debates in the United States in the late 1950's, describes a long and protracted conflict between scientists over the feasibility of a nuclear test ban. In this debate the scientists involved did not give ground but rather escalated their rhetoric to accuse their opposites of political bias (Gilpin 1962, p. 265). These scientists were equally involved and opposed in the debate. The debate had a parallel structure. This type of finding is the result of two interrelated factors which are general in the literature: the type of scientific population chosen for study, and the reliance on public information as the major data base.

Gilpin is cautious in the development of his study in that he recognizes that the "vocal" scientists he has focussed on may not necessarily represent the opinions of the "effective" scientists in terms of policy formation. Gilpin argues that their representativeness is based on his knowledge of other scientists in and out of government as revealed by public statements, articles, and through his contacts and interviews (Gilpin 1962, pp. 8-9). This representativeness is not, however, argued systematically.

The question of the actual representativeness of this particular group of vocal scientists is not at issue. The point is, however, that the problem that Gilpin has chosen concentrates on vocal and largely self-organizing scientists. These people have a fairly clear idea of their opposition, and are all attentive to and involved in the debates. The focus in the literature is in general on these types of groups. For example, Mazur concentrates on the leaders of the anti-nuclear low radiation movement (Mazur 1973) and Nelkin examines the opposition, by a group of scientists, to the location of a nuclear generating plant (Nelkin 1971). The selective focus using public information on highly involved and polarized debaters is perhaps best illustrated in the work of Robbins and Johnson on the low level lead debates (1976) where they indicate that the scientists which they analyze are not representative of the spectrum of involvement in the discussions:

> These two viewpoints - the one emphasizing 'sub-clinical hazards' and the other emphasizing 'clinical safety' - represent extremities of the spectrum of opinion.
> The controversy attracted the attention of a wide range of scientists, including chemical analysts, ecologists, botanists, agricultural scientists, and medical scientists, who took up stances of varying opinion and intensity. As the issues raised health questions, many physical scientists were only marginally involved, whereas medical scientists, particularly those whose work was clinically oriented, were highly committed.
> (Robbins and Johnson 1976 p. 357)

After pointing to this range of involvement and opinion variation, Robbins and Johnson continue their analysis of the lead debates by totally concentrating on the extreme debaters. They are not, as they claim, analyzing the low level lead debate. They are analyzing the extreme and polarized lead debate.

In the particular case of the Mackenzie Valley Pipeline Inquiry, I have argued above in Chapter 3 that organizational sponsors structured the debate in the hearings. This resulted in different levels of organizational integration of scientists dependent on the circumstances of their client organization. This alters the image of a parallel structure, at least on an organizational level.

There is however, a more critical point to be made. This is that the literature overwhelmingly relies on vocal scientists and the public record in constructing these parallel accounts and thus may be underemphasizing the importance of other factors. There is no systematic attempt in the literature to analyze the opinions of less vocal participants in these debates. It is possible that the parallel image may be in part an artifact of this reliance on public statements which could highlight contested points between aggressive participants or accentuate extreme arguments constructed for rhetorical purposes. In contrast to this general programme,the present research relies primarily on interviews with a large sample of all of the participants who were identified as taking part in a particular discussion. Vocal and less vocal participants are considered. Using these data,an analysis of the patterns of conflict among participants is undertaken.

In this analysis,the focus on the organizational level of conflict is also an important feature of the present work. Kopp,in her examination of the debate over fallout hazards in the United States,points to the organizational basis of at least some conflict between scientists (1979). She describes how the disagreement between two groups of scientists was associated with three factors: disciplinary association (biological vs. medical), political view (for or against nuclear weapons), and institutional affiliations (the California Institute of Technology vs. the Atomic Energy Commission). Kopp's analysis is very preliminary and she does not attempt to analyze these interrelationships:

> ...my purpose has been to describe rather than conclusively to demonstrate interrelations between disciplinary, institutional, and political contexts of the debate over fallout hazards. (Kopp 1979 p. 419)

I am attempting in this study to sort out some of these interrelationships. Kopp's analysis, like that of Gilpin, demonstrates a parallel structure with the disciplinary, political, and institutional factors lining up to reinforce each other. Medical, A. E. C., pro-nuclear weapon scientists disagree with biological, CALTEC, anti-nuclear weapon scientists on the issue of the dangers from fallout. I argue below that organizational patterns were important for structuring the conflict experienced by participants. I demonstrate that the organizational component is not overlapping in a parallel fashion as is implied in the literature. The organizational component's influence is complex and important for structuring conflict.

The primary source of participants' evaluations in this Chapter comes from the interview questions which ask participants to evaluate the contribution to the Inquiry of organizations other than those with which they were associated Participants were asked the question "What do you think of (organization)'s impact assessment and input into the Inquiry?" for each organization. These evaluations are then classified as "positive," "negative," "mixed," "do not know or no comment." These evaluations are displayed in a series of six tables, one for the discussion of the views of each group of participants associated with a particular organization. The discussion of these subjective evaluations utilizes an understanding of the interactions within the Inquiry which is based on a reading of the Inquiry transcripts and the information provided by participants.

The chapter is organized into six major sections. The next four sections examine the views of each group of participants associated with the five interest groups who put forward biological evidence at the Inquiry with CARC and COPE discussed in the same section. The sixth section is a summary discussion.

II Arctic Gas Participants' Comments on Other Inquiry Participants

Arctic Gas participants were very much like the vocal populations analyzed in the literature, in that they were all attentive to and involved in the debate. Arctic Gas was the major proponent of pipeline development. This company had conducted a large body of research to aid in the design and support of their application. At the hearings they were charged with explaining and justifying their position. The evidence presented by other organizations was largely a response to Arctic Gas. Arctic Gas, therefore, became the focus of the environmental discussions.

Arctic Gas participants' comments on the other participants in the Inquiry reflect the conflicts which arise out of their central and defensive situation. These conflicts were not however uniform, and they do not always correspond to the conflicts which were aired in the public record. The views of Arctic Gas participants are summarized in Table 2 on page 121 .

Four Arctic Gas scientists and two lay persons made negative remarks on Foothills. The criticism directed at Foothills by Arctic Gas participants is comprehensive and centered on the lack of development of the Foothills case. For example here are the comments of a biological advisor:

> What work? Foothills drew a line on a roadmap and submitted that as an application, and did very little more. It made a farce of the whole process. Arctic Gas came along and we had gathered about six or seven years of information and had done a reasonably good job and then here comes this Johnny-come-lately at the eleventh hour. They file a document that really says nothing, no information whatsoever. The only information that they had was what they gained from Arctic Gas basically. It just made a schmozal (sic) out of the whole bloody process of environmental impact assessment.

One Arctic Gas participant went as far as to question the honesty of Foothills participants. The public record does not support this level of criticism in relation to biology. Foothills was largely supportive of the Arctic Gas biological case except for stating that the Foothills route was superior since it avoided crossing the Northern Yukon (MVPI vol. 99). Arctic Gas also did not concentrate its public efforts on criticizing the Foothills case in biology. The challenge posed by Foothills was not, therefore, founded on a fundamental difference of opinions. However, on an

TABLE 2

Evaluations of
Other Participant Organizations
by Arctic Gas Participants *

Organizations

Evaluations		Foothills	E. P. B.	CARC	COPE
	Positive		1	1	2
	Mixed	1	3	2	3
	Negative	6	3	4	3
	Do not know or No comment	1	1	1	
	TOTALS	8(9)#	8(9)	8(9)	8(9)

*Based primarily upon responses to the question:

"What do you think of (organization)'s impact assessment and input into the Inquiry?"

the number in brackets is the total sample size

organizational level Foothills was competing with Arctic Gas in a way which the intervenors were not. It was possible that they would get to build a pipeline and this possibility could be far more threatening than criticism by intervenors. Vigorous criticism from intervenors was after all to be expected.

On a different level Foothills' case threatened Arctic Gas participants by indirectly questioning their independence and credibility. A major theme in the comments of Arctic Gas participants is the scientific and objective nature of their case. This objectivity is continually related by them to their role as scientists, and through this to the studies they had undertaken, and the length of time they had devoted to analyzing their data. The repeated referral by Arctic Gas participants to this scientific objectivity is an indirect claim for independence from their clients. Foothills was another industrial concern which managed to collect together a group of scientists to make statements on the environment which tended to advance their case. Foothills did this without the background research and time which characterized Arctic Gas' effort. At the hearings Foothills, as a proponent, was at least theoretically equal to Arctic Gas. This reflected adversely on Arctic Gas since the fact of having scientists give testimony in support of Foothills could be seen to cheapen the currency of scientific objectivity as an apologetic device. This threat to the legitimacy of the Arctic Gas case is reflected in the comment by the biological advisor quoted above that Foothills ". . . . made a farce of the whole process".

It should be noted that of the remaining sixteen non-Foothills Inquiry participants there were ten "negative" comments on Foothills, four "don't knows", one "mixed", and only one "positive." Foothills was the most negatively assessed organizational participant at the Inquiry. This corroboration of Arctic Gas's assessment of Foothills could be seen both as a vindication of Arctic Gas participants' comments and as a basis for the threat to the legitimacy of scientific expertise associated with industry.

The E. P. B. faired only slightly better than Foothills in the eyes of Arctic Gas participants, with three "mixed" and three "negative" remarks. Like Foothills, the E. P. B. posed somewhat of a threat to the authoritativeness of Arctic Gas' impact assessment. The Board had been in existence for as long as the Arctic Gas research effort, so that the legitimation of the Arctic Gas assessment as developed over this time could also apply to them. When the Board disagreed with Arctic Gas, this could invalidate the authoritativeness of the Arctic Gas assessment in so far as this was dependent on the time available for study. This organizational threat was not, however, on the scale of that posed by Foothills.

When there was disagreement between Arctic Gas and E. P. B. participants, this followed the pattern of the vocal scientists usually studied in the literature. All of these participants were aware of each other and involved over time in a dialogue about the impacts of pipeline development (see section below on the E.P.B.). This conflict is in the public record. In this sense a polarization between those who had differences of opinion seems to have occurred.

As I outlined in Chapter 3, the E.P.B. participants were split in their assessment of the impact of pipeline development. This was apparent publicly in the differences in criticism and support for the pipeline. This made the comments by Arctic Gas participants complex in that they had some positive reactions to certain members of the E.P.B. while they were very critical of others. This resulted in the "mixed" remarks and the concentration by some Arctic Gas participants on criticism of particular individuals within the E.P.B. For example, one of the witnesses who was coded as making a mixed remark commented that in his area the work was good, but singled out an individual outside of his area and described him as "unqualified" to make environmental judgement. In total three Arctic Gas participants made personal attacks on members of the Board. The most elaborate of these attacks was made by a lay person who explained the split in the Board and then systemmatically accused those members of what he labelled "the extreme academic faction", of emotional and biased contributions to the hearings. This participant was classified as making "mixed" comments since he praised what he considered to be the "moderate faction" in the Board. These comments demonstrate that the "mixed" remark classification underestimates the perception of conflict between Arctic Gas participants and some members of the Board. The E.P.B. is not dealt with as a homogeneous group by Arctic Gas participants, as clearly it was not. Unlike the case of Foothills, the conflicts between Arctic Gas and some members of the E.P.B. are shown in the public record and in the interview responses.

Criticism of the intervenors by Arctic Gas participants, although no less intense, was less uniform than that of Foothills or of E.P.B. . Unlike Foothills, and to a certain extent the E.P.B., the conflict between Arctic Gas and the intervenors was centred on issues. Both CARC and COPE did not intend to build a rival pipeline, and they did not have the resources to present a comprehensive research programme to challenge that of Arctic Gas. They were, however, the major public critics of the pipeline. The concentration on issues is evident in the existence of positive remarks on CARC and COPE by two Arctic Gas witnesses. For example, one witness made positive remarks about both CARC and COPE as organizations, pointing to the major contribution of CARC in bringing forward government witnesses and the usefulness of COPE's questioning. This person was not heavily criticized during the hearings by witnesses for either of these organizations. An important qualification here is that this person also stated at another point in the interview that opposition to the

Arctic Gas case was largely biased and emotional, although he did not specify his comments to refer to either CARC or COPE or any person associated with these organizations. There were, of course, clearly "negative" assessments of both CARC and COPE. One witness stated that CARC had poor professional advice because they didn't ask the appropriate questions. This witness stated that they were "beating a drum" for a cause and that they abused science to serve their needs. Another witness commented that CARC had an "axe to grind", and that their witnesses in his area were not familiar with the project or the particular group of animals which were to be affected.

A lay person offered very critical remarks on CARC:

> Oh they were there to discredit the pipeline and prevent the pipeline from being built and to them the ends justified the means. They would say anything, do anything. Anything they could do to discredit the company was fine. Anything that they could say that would help the native people, it didn't matter whether it was truth or fiction or libellous or anything. They were without a doubt in my estimation the most dishonest participants in the whole hearings, plus the most ineffective.

COPE received similar treatment at the hands of Arctic Gas participants. The range of comments is however greater for both CARC and COPE than it was for the critical faction of the E.P.B. or Foothills. This can be seen to be linked to the relative focus on issues in conflict in relation to biology and the relative lack of organizational threat in comparison to the E.P.B. and Foothills. Evidence for the issue focus in biology comes from the positive remarks by two witnesses. In contrast, the lay persons gave only mixed or negative remarks since their concern was more organizational and less tied to the biological debates. Criticism was however dominant and should not be underemphasized.

In summary, the comments by Arctic Gas participants on other organizations present a complex pattern of conflict. Arctic Gas participants responded to others not only in terms of whether they agreed with them but also in terms of the extent to which these other organizations presented a threat as organizations to the legitimacy of the Arctic Gas case. This comes through most clearly in the case of Foothills where there was a large amount of agreement in the public debates matched by unanimous condemnation in the interviews. Their comments on CARC and COPE present an interesting contrast to this pattern in that the critiques of these organizations seem to have been affected by a focus on issues and not on the threat of these organizations as organizations.

This pattern of conflict is far more complex than is usually presented in the literature on conflicting expertise. In a sense the conflicts between Arctic Gas and the intervenors have a parallel structure in that scientific conflicts are supported by competing organizations. However, the case of Foothills demonstrates a different situation with the tensions between competing organizations undercutting scientific agreement among participants.

III Foothills Participants' Comments on Other Inquiry Participants

Foothills, like Arctic Gas, was cast in a primarily defensive stance during the Inquiry. Foothills had to defend its development proposals. Unlike Arctic Gas, Foothills had not developed an extensive body of research since it had only entered the pipeline competition at a late date. For example, Foothills' witnesses in biology had only been retained by Foothills for from three to six months before they testified at the Inquiry (see Chapter 3 above). As a result, Foothills had very little biological evidence to present, with Foothills' witnesses appearing on the stand for only three days. This can be compared to the Arctic Gas biological panel which was on the stand for sixteen days. This lack of research effort, coupled with the apparent relative unimportance of their proposal, translated into a lack of public criticism by the other participants. This public stance by other participants was, however, not mirrored in their interview comments, with Foothills being the most criticized organization at the Inquiry. Foothills participants' lack of overt confrontation is reflected in their comments on other participants. Foothills participants' comments are summarized in Table 3.

Foothills participants' comments on Arctic Gas were almost an exact reversal of the universal condemnation of Foothills by Arctic Gas participants. Foothills participants had the largest proportion of "positive" assessments of Arctic Gas than of any of the organizational groups examined

TABLE 3

Evaluations of
Other Participant Organizations
by Foothills Participants *

Organizations

Evaluations	Arctic Gas	E. P. B.	CARC	COPE
Positive	4	4		2
Mixed	1	2	2	1
Negative	1		4	2
Do not know				1
TOTALS	6(6)#	6(6)	6(6)	6(6)

*Based primarily upon responses to the question:

"What do you think of (organization)'s impact assessment and input into the Inquiry?"

the number in brackets is the total sample size

in this study. Four out of six Foothills participants had positive things to say about Arctic Gas in contrast to only two participants in the remaining four populations.

An example of a "positive" comment by a Foothills witness was that Arctic Gas was more "holistic" in its approach and its work "...was far superior to what Foothills did, but I think that was partly a function of time". At the other extreme, the only Foothills participant with a negative remark, a lay person, accused Arctic Gas witnesses of dishonesty in the service of their client:

> ...they were really prepared to say almost anything that the client wanted them to, some of them, just some of them, not all of them.

For Foothills witnesses, conflict could not be too severe over the biological case because Foothills depended on the biological work of Arctic Gas in making its assessments. In this sense the value of Foothills work is dependent on the credibility of Arctic Gas. This, paired with the lack of conflict between Arctic Gas and Foothills experienced by Foothills witnesses in the Inquiry, helps to explain this asymmetry between Foothills and Arctic Gas assessments of each other. Indeed, it appears that one Foothills witness came to identify directly with the position of Arctic Gas. In criticizing the presentations of both of the environmental intervenors this witness concentrated his comments on the debate on the impact to the Porcupine Caribou Herd on the north slope of the Yukon.

> I thought the whole show with respect to caribou on the North Slope was ridiculous... they were talking about should you be doing behavioural studies. And then (scientist) came back with says well we thought that getting the basic distribution, calf-cow indices, range was more important than behaviour, and they just kept on with behaviour. They just kept on and on. And I thought they should have just given up. Once they said we felt it was more important, it is just a matter of scientific judgement. And then they went into a really ridiculous little scene which lasted quite a long time on aircraft disturbance to caribou.

Indeed, Foothills witnesses were more critical than Arctic Gas witnesses of CARC and COPE. None made a remark which was coded as positive, in contrast to three "positive" remarks made by two Arctic Gas witnesses. This was so even though these witnesses experienced this conflict only indirectly. This lack of direct experience was greater with COPE than with CARC, with one witness stating that he was not able to comment on COPE's involvement.

This absence of direct conflict should not, however, be equated with an absence of contact with intervenor participants. For example, the witness quoted above, who criticized the intervenors' caribou attack of Arctic Gas, also stated at another point in the interview that he got along well with biologists associated with one of these organizations and that, during what he termed "beer talk" with them, he found that they agreed on many issues. These scientists were some of the experts who made the attack on Arctic Gas over caribou. The lack of conflict in the quoted witness' direct experience seems to have been superseded by his identification with the

Arctic Gas case in relation to caribou as reasonable, and the attacks as unreasonable. This identification came about even though caribou biology was not his area of expertise.

There is considerable difference between this "second-hand" conflict and the first-hand experiences of the Foothills' lay persons. Foothills' lay persons were far more positive than Arctic Gas participants about the intervenors since they reacted to these organizations in terms of the interests of the organization and not in terms of the substantive issues which preoccupied the witnesses. For example, here are some of the comments of one lay participant on the same North Slope caribou evidence which annoyed the witness quoted above:

> Their evidence on the North Slope we found useful because largely it dealt with caribou... Foothills, because it didn't go through areas of caribou, or significant caribou populations... did not have a real caribou expert, so we tended to sort of sit back and let CARC do a job on Arctic Gas during that particular phase, and they did quite a good one.

In the case of Foothills' reactions to intervenors we see witnesses reacting to the general positions of these organizations. Since these positions were usually articulated in relation to Arctic Gas, Foothills witnesses were in essence identifying with the Arctic Gas situation.

Foothills participants' comments on the E.P.B. were as positive as those on Arctic Gas with four "positive" remarks and two "mixed". These comments were not by and large elaborately developed but were confined mostly to statements like they played a "valid role". None of the Foothills witnesses recognized the connection between Foothills and the E.P.B.. In contrast one of the Foothills lay persons drew a connection between Foothills and the E.P.B.. He elaborated how Bob Blair, the president of Foothills, had created the Board and that in a way the E.P.B. should be included "as part of Foothills assessment" because of this connection. He illustrated his point by indicating that Foothills "...picked him (Templeton) up for the Alaskan highway" to do environmental work after the Berger Inquiry. This person went on to say "They (E.P.B.) were really neutral...By and large I couldn't disagree too strongly with what they had to say".

The fairly positive set of evaluations of the E.P.B. by Foothills participants is indicative of the lack of conflict between these organizations during the hearings. E.P.B. participants were critical of Foothills (see below) but this did not surface in attacks upon the Foothills position during the Inquiry. The E.P.B.'s evidence at the Inquiry was directed toward the Arctic Gas application. The Foothills application surfaced as an independent proposal only after the compilation of the report of the E.P.B.

In summary, the Foothills witnesses present another contrast between the public record of conflict and their perception of conflict. Intervenors were not heavily critical of Foothills biological testimony throughout the hearings, yet Foothills witnesses were quite critical of intervenors. They did this since they formed opinions on the substantive debates. Since these discussions were elaborated in relation to Arctic Gas, these witnesses in a sense came to identify with the major defense of an industrial position, that of Arctic Gas. In line with this point, Foothills participants are very positive about Arctic Gas' case. This was consistent with the public record but is not reciprocated by Arctic Gas participants. I show below that the same pattern occurs between Foothills and the E.P.B.

IV The E.P.B. Participants' Comments on Other Inquiry Participants

The E.P.B. was the first organization to present environmental testimony at the Inquiry. In accordance with their mandate, their work was directed at an assessment of the Arctic Gas application. This assessment was formally supportive of Arctic Gas in that it stated that, provided all of the terms and conditions they outlined as necessary in their report were followed, the pipeline application would be acceptable. In the course of the hearing, however, there was some overt conflict with Arctic Gas on specific points. In one case Templeton, the Chairman of the E.P.B., had a conflict with Banfield of Arctic Gas on the relative merits of their respective environmental assessment methodologies (MVPI vol. 107). In another instance, McTaggart-Cowan, the zoologist on the Board, took exception to both the coastal and the interior routes of Arctic Gas on the grounds that they would interfere with the Porcupine Caribou Herd

(MVPI, vol. 108). There was also an organizational conflict with Arctic Gas in the sense that Arctic Gas had decided to terminate its funding of the Board, thus necessitating its dissolution (MVPI, vol. 109). In Chapter 3, internal lines of conflict were discussed. In this chapter, this split is shown to carry through consistently in E. P. B. participants' comments on other organizations. In this sense, the E. P. B. scientists demonstrate a classic polarization of the type described in the literature. They were involved in the debate for a prolonged period of time and have crystallized their opposing views.

The distribution of E. P. B. witness's views clearly indicate the lines of conflict. The witness who was favourable toward Arctic Gas has a "positive" Arctic Gas assessment and "negative" Foothills, COPE and CARC assessments. In contrast, the witness who was critical of Arctic Gas has a "mixed" remark in relation to Arctic Gas, a "negative" comment on Foothills, and "positive" remarks for CARC and COPE. The "mixed" coding in relation to Arctic Gas was the most common one given to participants in this study, since participants most often recognized the effort and quality of the Arctic Gas research programme. This was done by this witness but he went on to accuse two Arctic Gas witnesses of dishonesty, thus resulting in a "mixed" coding. The pro Arctic Gas witness appears to have totally adopted the perspective of those in Arctic Gas in his pattern of criticism. The extent to which this person identified with Arctic Gas, and industry in general, is difficult to overstate. While describing Arctic Gas this person repeatedly referred to himself as part of the Arctic Gas effort, for example "We started off in Arctic Gas". This participant also spoke very warmly of the relationships he developed while working with industry:

> ...mutual respect, playing devil's advocate with each other, giving and taking, but even personal friendships came out of this so that I view that I have friends in Calgary on a permanent long term basis that far exceed any individual project or anything of this kind. And I have a much greater feeling for some of the thought processes and the activities that people in industry get caught up in.

This dramatic split in the comments of these two witnesses is further evidence of the inability of the E.P.B. to forge a unified perspective and set of allegiances on the part of its members.

The original organizational ties with Alberta Gas Trunk, later the force behind Foothills, the subsequent change of sponsor to Arctic Gas, and the tensions which this brought about, are clearly evident in the remarks of the lay person. This person had been involved more closely with the organization of the Board. He criticized Foothills for not doing very much work,but praised Bob Blair, the President of Alberta Gas Trunk and Foothills for introducing:

> ...environmental and social matters into the process because without him that wouldn't have probably even have been done.

On the other hand this person was critical of Arctic Gas not only in terms of their work,but also in relation to what he characterized as their attempts to "control" the Board and its research.

In summary, the E. P. B. participants demonstrate a clear case of polarization so commonly found in the literature. This split was publicly visible and paralleled by the participants' interview comments. One of the origins of this split was the confusion over sponsorship and direction within the Board and its resulting inability to collectively define the issues. This organizational base, and the tension which it generated, are clearly reflected in the comments of the lay participant quoted above.

V CARC-COPE Participants' Comments on Other Inquiry Participants

In contrast to their close public alliance in their criticism of Arctic Gas, the interview comments by intervenors on each other indicate a certain amount of intergroup conflict. Three of the four "negative" comments made by CARC and COPE participants on each other (two each way) are directly indicative of particular areas of tension in this relationship and deserve some detailed attention (see Tables 3 and 4).

First, one COPE witness gave a fairly detailed account of his frustrating experiences with CARC. This witness was a government scientist. His encounters with one CARC scientist in particular were related throughout his comments on CARC and suggest a great deal of personal conflict as well as a clash of perspectives between a private

TABLE 4

Evaluations of
Other Participant Organizations
by CARC Participants*

Organizations

Evaluations	Arctic Gas	Foothills	E P B	COPE
Positive	1	1	5	3
Mixed	5		1	
Negative	2	5		2
Do not know				1
TOTALS	8(8)#	6(8)	6(8)	6(8)

*Based primarily upon responses to the question:

"What do you think of (organization)'s impact assessment and input into the Inquiry?"

the number in brackets is the total sample size

TABLE 5

Evaluations of
Other Participant Organizations
by COPE Scientists*

Organizations

Evaluations	Arctic Gas	Foothills	E P. B.	CARC
Positive				1
Mixed	3		1	1
Negative	1	2	1	1
Do not know	1	3	3	2
TOTALS	5(5)#	5(5)	5(5)	5(5)

*Based primarily upon responses to the question:

"What do you think of (organization)'s impact assessment and input into the Inquiry?"

the number in brackets is the total sample size

citizens' group and the public service. This person related how there had been a conflict over the release of a government document.

> ...he made everything sound like it was a big conspiracy with the oil companies and that sort of stuff that this report wasn't released. And that wasn't the case at all. I was a little put off by him. And I donated money to him and all that. I think they slipped from their main objective into other stuff and as a result it affected their credibility.

One of the dominant themes which arises from the comments of the central CARC organizational actors is the importance, for them, of the availability of information for public debate. The availability of information is for these people a basic democratic question. At times, this position of openness is coupled with a distrust of industry and government intentions. For example, here are some comments by Kitson Vincent, the executive secretary of CARC, at the time of the hearings:

> In every area of private endeavour the Federal Government seems intent upon crushing independent inquiry... The two elephants (government and the petroleum industry) joined forces several years ago and have since spent millions of dollars telling Canadians of the immediate need for a Mackenzie Valley gas pipeline. They tied up most of the country's northern experts on lucrative contracts. Many are still on contracts and remain effectively silenced... The attempts to stifle plurality in this country must be fought. During the past few years CARC has tried to bring an objective voice into the dialogue reserved for the energy giants and the federal and provincial governments... (Vincent 1976).

This demand for information and the democratic political perspectives of both groups of intervenors could be very threatening to government scientists, especially if this demand related to their area of information control. This appears to have happened in relation to the witness referred to above.

This was not a conflict between CARC and COPE as organizations but between the perspectives of some government scientists, which they had to rely on as witnesses, and the perspectives of public intervenors. These same tensions were elaborated above in Chapter 3 on the social organization of scientists in the Inquiry.

A second source of tension was more inter-organizationally related. One CARC witness criticized a COPE associated scientist for being too much in favour of the native peoples as opposed to the defense of the animal populations:

> Well I had a bad experience in (place) recently. I really, the Inuit at (place) really gave me a hard time. They stopped translating. And (a biologist associated with COPE) was pushing the natives so hard. Didn't seem to recognize that they might have a few faults... You know I'm (species) first you know, and if it comes down to natives versus (species), (that biologist associated with COPE) would be with the natives for sure...

A concern for native peoples and a concern for animals did not always mesh in the mind of this participant. It should however be emphasized that officially there was no tension along these lines between CARC and COPE. This highlights, however, how some participants who may have an interest in biology may not also support the freedom of native peoples to harvest species in their area of interest.

The third inter-organizational negative comment which highlights an area of tension was made by the COPE advisor on CARC. This person's comments did not indicate any disagreement between CARC and COPE on substantive issues, but rather criticized CARC for not mobilizing its organizational resources in an effective way:

> You touched a nerve. I really don't know what to say... They just didn't come through with the goods you know. They were going to be a major backup for the native groups, and they were going to do this, and they were going to do that, and they were originally going to organize the whole delta phase of the hearings, and on and on. And they didn't come through. The only one that did was (scientist) and he arranged for us to have an assistant during the delta phase. That was really important to us, but we organized it. We put it together. We expected more assistance in the living environment. They weren't even there most of the time. Look at the transcripts. And we felt they weren't providing input either. We expected that they would be there all the time. They had financial troubles. That was one of the reasons I guess. They didn't lack for brains but somehow it didn't all mesh... We were expecting more of them, and perhaps we shouldn't have.

This participant went on, however, to compliment CARC on their caribou panel. These comments are very similar to those of some CARC participants on their own organization (see Chapter 3 above). There was, therefore, a strong perception which ran through members of the environmental intervenor community that CARC did not do a good job. This can be seen to reflect the lack of resources of CARC and the high expectations placed upon the organization to represent the environmental interests.

Although there were tensions in the relationships among some members of CARC and COPE, the structure of their association was co-operative. They were both attempting to question the industrial proposals and in doing this had to rely on each other's resources. An indication of this relationship is provided in the "positive" comments of one CARC lay person on COPE:

> ...it is a very difficult and onerous task for...any group to be that active on that complicated an issue, and therefore the fact that we could take the lead and COPE could fill in the gaps for us meant that...(we)...spent a lot of time saying well you ask these and I'll ask these questions, and you do that research and I'll do that research. And this sort of tag team approach was very important from our point of view. It's about the only way you can really do the job.

This co-operative relationship and general similarity of perspectives is reflected in the inter-organizational migration of personnel described above in Chapter 3, and the four "positive" comments made by CARC-COPE participants about each other.

The binding force between CARC and COPE participants is their views of the industrial parties. Only one CARC-COPE participant, a CARC witness, had a clearly "positive" appraisal of Arctic Gas' assessment. This person stated that "it was quite good" and singled out the "quality of the people that did the work" as a positive factor in Arctic Gas' case.

In contrast,eleven out of thirteen CARC-COPE participants made either mixed or negative remarks on Arctic Gas. Eight of these CARC-COPE participants, the largest group, had mixed comments. The positive element in their remarks was, in general, their high regard for the quality of the Arctic Gas studies. These positive elements were however undermined by a variety of negative features. For example, two witnesses stated that they thought that Arctic Gas' inventory and distribution work was excellent.but Arctic Gas was said to have not considered the dynamic aspects of the situation. Here are some of the comments of one of these CARC scientists:

> The strength was the distribution, the distribution and movement and census. . ..They were supposed to be involved with behaviour because they're worried about the behaviour of these animals, and they didn't bring in a first class behaviourist, and they didn't really spend the long hours looking at animals.

The three negative comments did not include any element of praise. For example one CARC lay person stated that he thought the Arctic Gas assessment was "a public relations document". This person developed his remarks by criticizing one of the witnesses for Arctic Gas:

> . . . he was so biased in favour of building a pipeline that he couldn't be objective. . . he gave the impressions that building this pipeline across the North Slope would not only not hurt the caribou but probably would be beneficial to them. And that to me, from what I've read, seemed ridiculous.

CARC-COPE participants comments on Foothills were less flattering than those for Arctic Gas. Only one participant, an organization person, made "positive" comments about Foothills. This person pointed to Foothills' responsiveness to the Inquiry process and ability to act quickly as strengths of the Foothills representation. Seven of the CARC-COPE participants made "negative" comments about Foothills. The major remark made by five scientists who made "negative" statements, was that Foothills had not done the work. Here are some of the comments of these scientists:

> They had no data. They had done nothing.
>
> I laugh at that because they had, they had absolutely no, no expertise, no input.

There were three COPE witnesses who made "do not know" remarks in relation to Foothills. In contrast, only one COPE witness made a "do not know" remark in relation to Arctic Gas. This is an indication of the lower profile which Foothills struck at the Inquiry in comparison with Arctic Gas. It is also an indication of the lack of involvement in the general debate on the part of some of the intervenor witnesses.

The E.P.B. was not a proponent of development.and the intervenor's case at the hearings was not, therefore, structured in relation to the E.P.B. testimony. As discussed above, the E.P.B. did have members within it that criticized the Arctic Gas case, and it appears that CARC-COPE participants largely identified with these elements when commenting on the E.P.B.. This results in five positive comments by CARC participants praising the thoroughness, usefulness, and effectiveness of the E.P.B. involvement in the hearings. Only one participant separated out the two factions within the E.P.B. and made positive remarks about the participants who were critical of the industrial case and negative comments on E.P.B. participants who were favourable to Arctic Gas. The lack of focus for COPE witnesses in relation to the E.P.B. is clearly demonstrated in the three do not know remarks. In summary CARC-COPE participants were highly uniform in their criticism of both of the industrial proponents. In doing this CARC-COPE participants demonstrate a higher degree of cohesiveness with respect to their attitudes to industry than to their own organizations. This provides evidence for the importance of the industrial case as a focus for intervenors. Intervenors were organized around a critique of the industrial case and not in terms of a defense of their own official position, or on an agreement with each other on the nature of their criticism. Further indication of this focus on criticism is that only one COPE witness was unable to make comments on Arctic Gas while two COPE witnesses were unable to make comments on their own organizational sponsor (see Chapter 3 above). These witnesses were more familiar with their object of criticism than with their client.

VI Summary Discussion

There are five major empirical points which emerge from the analysis in this chapter: first, that there was a considerable amount of conflict among participants; second, that this conflict is not always reciprocated; third, that the public record and face-to-face aspects of conflict among participants is not always paralleled in the critical evaluations made by participants; fourth, that the social organization of scientists is reflected in this pattern of conflict; and fifth, that conflict among organizations can cross-cut or reinforce intellectual agreement or disagreement.

The evaluations by participants of other participants are one way of measuring conflict but it should be kept in mind that this is not a measure of intellectual or professional agreement and disagreement. For example the Arctic Gas witness who said positive things about CARC and COPE's involvement in the hearings was also clearly critical of intervenor positions on the impact of pipeline development. Given this feature of the evaluation data, the information presented in this chapter indicates a high degree of conflict. The comments of the proponents (Arctic Gas and Foothills) about the environmental intervenors (CARC and COPE) were generally negative. Out of forty-six comments made by proponents on intervenors and intervenors on proponents, twenty-three were "negative" and, perhaps more importantly, only seven were "positive."

This quantitative indication of conflict was reinforced by the qualitative analysis of participants' remarks elaborated above.

The second major point is that the criticism was not always reciprocated. This was demonstrated most clearly in the case of the comments by Foothills and Arctic Gas participants about one another. Six of the eight Arctic Gas comments about Foothills were "negative" (with none being positive) while four of the six Foothills comments about Arctic Gas were "positive". A similar pattern occurred between Foothills and the E.P.B.. The Foothills case has been argued in terms of the concern of industry funded representatives to establish the legitimacy of their case. From the point of view of Foothills, the legitimacy of these other industry sources of information was endorsed since they relied on this information as part of their case. From the point of view of Arctic Gas and the E.P.B., the Foothills presence, with their lack of preparation, posed a threat to the legitimacy of industry submissions generally. This concern for credibility is explored in greater depth in Chapter 5 below.

The lack of symmetry in the above example leads to my third point. This is the important observation that the public record, and to some extent the face-to-face interaction in the Inquiry, is not always paralleled by the comments of participants. This is clearly revealed in the case of Foothills, the most negatively evaluated participant according to the interview responses. At the Inquiry the testimony in biology put forward by Foothills was largely let pass without detailed critique. One Foothills witness reinforced the impression of this smooth passage by relating how informally, over drinks, the scientists associated with the environmental intervenors and he had found a minimum of conflict between their positions. Some of these same people furnished criticisms of the Foothills' position during the interviews.

The fourth point, that the social organization of participants is reflected in some of their critical remarks, is clearly seen in the case of the two environmental intervenors. The heterogenous alliance of various interests and the lack of integration of scientists within these organizations is reflected in the mixed responses of environmental participants about each other. Although formally allied, only one of the five COPE comments about CARC, and only three of the six CARC comments concerning COPE were positive. A further indication of lack of integration is found in the three "do not know" remarks which were also offerred by CARC-COPE participants about each other. However, intervenors were generally in agreement in their critique of the industrial case. Evidence for this was provided by the almost uniform critical remarks on Arctic Gas by these participants. The question of organizational coherence and its effects on the ideas of participants is explored in depth below in Chapters 6 through 10.

In this respect, an important point which emerges, if the findings of this and the previous chapter are put together, is that the proponents were organized around the defense of a position while the intervenors were organized around the critique of the proponents' case. Organizational integration was necessary in the defensive stance of proponents and unnecessary in relation to the critics. Critics need not agree or get along with each other.

The fifth finding is that organizational sources of conflict can cross-cut or reinforce intellectual agreement or disagreement. The reinforcing aspects of organizations on intellectual disagreement or agreement are clearly displayed in the bringing together of experts to argue for or against pipeline development by the various organizations at the Inquiry. The cross-cutting features of organizational sources of conflict are most clearly evident in the cases of the relationships between Arctic Gas and Foothills, and CARC and COPE. In both of these cases, considerable areas of intellectual agreement were countered by organizational sources of conflict.

The literature on conflicting expertise implicitly constructs an image of conflicting expertise as having a parallel structure. Whether writers accentuate the political perspectives of scientists (Nelkin 1979, Mazur 1973, Gilpin 1962) or the disciplinary traditions of particular groups of scientists (Robbins and Johnson 1976), the image of conflict which is generated is a parallel one, with two sides being equally and oppositely opposed to each other. This image of a parallel structure is considerably undermined by the findings in this chapter. The image of conflict which emerges in my research is complex, including a lack of reciprocity (point two above), and organizational sources of conflict which cross-cut apparent intellectual agreement (point five above). An adequate consideration of these findings is best appreciated in light of the methodological and theoretical differences in approach between this and previous studies. These include the use of systemmatic interviews and a focus on social organization. Although not unusual in the sociology of science (see for example Mitroff 1974, Edge and Mulkay 1976), the use of systemmatic interviews with a sample population under study is novel to the study of conflict among experts. The usual procedure is to piece together a coherent common sense account of a controversy using public statements, documents, and informants in the various camps (see Nelkin 1971, 1973, 1979, Mazur 1973). There is little attempt in this literature to specify how these various components are weighted in relation to each other, or even to address the possible difficulties in using these various forms of data. The work by Gilpin (1962) discussed at the beginning of this chapter is perhaps the most rigorous in this regard. Gilpin, however, adopts this patchwork approach and justifies his tactic by stating that his interviews with principals, although not specified as to their representativeness, corroborate the consistency of the attitudes revealed in the public information upon which he so heavily relies. In contrast to this approach, I have chosen to rely on data generated in a systemmatic survey of discussion participants. This approach has generated a more complex and, I would submit, more accurate view of debates. As opposed to working with a sample of participants, which is biased in relation to prominent and vocal debators, I have included in my sample participants which represent a broader range of involvement and prominence.

The focus on the social organization of scientists is another feature of my study which differs from the literature. The major way in which groups are isolated within the sociology of science, following Kuhn (1970), is in terms of conceptual communities. This approach has carried over into the analysis of controversies in the work of Robbins and Johnson (1976), where they interpret the debate as a conflict between two communities of scientists schooled in different traditions. Although it is essential to consider the extent to which conceptual communities are important for the study of public controversy, the analysis of interest groups for the structuring of interaction in public discussions should also not be neglected. This is especially clear in the case of public inquiries where interest groups make presentations and quite often control the flow of scientific expertise. I have established that this is certainly the situation in the Berger Inquiry (see Chapter 3).

I have also demonstrated in this chapter that organizations and their interrelationships can structure how conflict is experienced by debators (point two above). This has demonstrated an added dimension in the analysis of conflict in controversies involving experts. Not only can organizations reinforce the public intellectual debate in a parallel fashion (see Kopp 1979) but they can also cross-cut areas of intellectual agreement (empirical point 5). This interactional analysis on an organizational level is of course preparatory to a consideration of the attitudinal differences among scientists in the debates on biology. This is undertaken in Chapters 6 through 10.

CHAPTER 5

THE SUBJECTIVE DIMENSIONS OF CONFLICT (II):
PARTICIPANTS AND THE COMMISSION

I Introduction

This chapter continues the analysis of the subjective dimensions of conflict which was begun in Chapter 4 above. In this chapter I outline the subjective aspects of the patterns of conflict between Inquiry participants and the Commission. I demonstrate that there was considerable conflict between the Commission and the proponents, particulary Arctic Gas. I also show that, undercutting the formal identity of interests between the Commission and the intervenors, there were some tensions. This dimension of conflict is an important feature of the debates which needs to be taken into account when analyzing the patterns of conflict and the crystallization of opinion within inquiries.

A major topic within the literature which deals with inquiries is the structure of inquiries and how these structures affect the discussions which occur within them. For example, the debate over the proposed science court, where the scientific questions involved in policy questions are to be clarified and adjudicated, concentrates in part on what effects the form of debate has on discussions. The concern is with determining what the best procedure would be for arriving at the most satisfactory conclusions (Kantrowitz 1967). Central to this discussion is whether adversary or mediatory styles should be adopted (see Green 1972). The examination of the structural constraints on debate has been dealt with in this study in the analysis of the social organization of expertise and in the consideration of the basic defensive or critical situations of the various interest groups.

There is, however, another dimension to inquiries which should be considered in the analysis of disagreements among experts. Inquiries not only contain debate, they become part of it. This point has been made clear by Doty (1972) in his analysis of the Operations Research Society of America (ORSA) investigation of the conduct and quality of the advice given by scientists in the anti-ballistic missile debates in the United States. The ORSA report sided with one camp in the debate. The report did not simply resolve the issues. It became part of the controversy with participants on either side reacting to the report (Doty 1972, p. 281).

Few analysts would disagree with this reactive component. Debate does not terminate with the conclusion of inquiries. The relative lack of concern with this dimension reflects rather a different focus for most writers than the present study. As in the case of the science court proposal, much of the literature on inquiries is oriented to the practical question of how to design effective assessment institutions. The interest in inquiries for these analysts is the quality of the procedure and report.

I am not interested in this study with how adequate the Berger Inquiry was in assessing the scientific information. I am engaged in a sociological analysis of the disagreements among biologists in the Inquiry. For my purposes the Inquiry discussions do not stop the moment before the report is released. The Inquiry report is the most concrete embodiment of the position of the Commission, and as such is part of the conversation within the Inquiry. Participants react to it and interpret their experience with the Inquiry in terms of it. The high profile of the report of an inquiry helps to structure the issues within an inquiry. In addition, some participants are "losers" and some are "winners" in the inquiry decision, resulting in different inquiry experiences.

The prominence of reports should not, however, obscure the active role of an inquiry during the discussions leading up to a report. Commissions of inquiry are not merely passive instruments. Commissioners and their agents can ask questions, make preliminary reports, conduct research, and fund the research of intervenors. How active a Commission is, will of course vary. In the particular case of the Mackenzie Valley Pipeline Inquiry the Commission was very active. The Commission did all of the above things as well as present the evidence of its own experts and maintain a high media profile, especially through the Commissioner, who made many public appearances. It is very important, therefore, in this particular case to consider the experience of participants with the Commission. However, the general importance of these considerations depends on the style and circumstances of the particular inquiry.

This chapter considers two sides of the relationship between the Commission and the interest groups. On the one hand, I consider the attitude of the Commission toward the various groups. On the other hand, I consider the attitudes of participants to the adequacy of the inquiry.

One of the main sources for Commission participants' views are their responses to the question "What did you think of (organization)'s impact assessment and input into the Inquiry?". Lay and scientist participants' comments were coded as "positive," "mixed," "negative," or "do not know." The distribution of these comments is displayed in Table 6. Public sources of information are also used in this analysis.

The consideration of participants' attitudes toward the Commission centers on the discussion of their replies to the question "What do you think of Berger's impact statement?". Again, lay and scientific participants' comments were coded as "positive," "mixed" or "unclear," "negative," or "do not know." These comments are summarized in Table 7.

TABLE 6

Evaluations of
Other Participant Organizations
by Commission Participants*

Organizations

Evaluations

	Arctic Gas	Foothills	E P B	CARC	COPE
Positive	1		3		1
Mixed	4			2	
Negative		1		2	
Do not know		1	1	1	1
TOTALS	5(6)#	2(6)	4(6)	5(6)	2(6)

*Based primarily upon responses to the question:

"What do you think of (organization)'s impact assessment and input into the Inquiry?"

the number in brackets is the total sample size

TABLE 7

Evaluations of
the Inquiry Report
by Participants by Organization*

Participants by Organization

Evaluations	Arctic Gas	Foothills	E. P. B.	CARC	COPE
Positive		1	2	8	3
Mixed or Unclear		3			
Negative	8	2	1		
Do not know					2
TOTALS	8(9)#	6(6)	3(3)	8(8)	5(5)

*Based primarily upon responses to the question:

"What do you think of Berger's impact statement?"

the number in brackets is the total sample size

The next four sections of this chapter are organized around a discussion of the five interest groups with CARC and COPE being considered together in the same section. The final section is a summary discussion.

II. Arctic Gas and the Commission

The lines of conflict between the Commission and Arctic Gas weave a pattern whereby the Arctic Gas participants' experience of conflict was very strong. Commission participants' interview comments on Arctic Gas are quite complimentary. Four lay and scientific participants made "mixed" remarks on Arctic Gas with a general pattern of admitting the quality of the work done, but clearly remaining skeptical concerning some major features of the work. For example, here are some of the comments of one lay participant:

> Arctic Gas deserves a lot of credit that they've never got for investing a great deal of time and effort in the whole area of preparing information for the Inquiry. I think the conclusions that they tried to draw were often a little more extreme than the evidence substantiated.

One lay person was even more complimentary to Arctic Gas with many "positive" comments:

> . . . the most significant impact assessment which had ever been done in this country and perhaps in North America which I guess means the world. It was honest and thorough, very elaborate, very extensive.

This person further explained that the Inquiry didn't disagree with the

Arctic Gas assessment. The Inquiry used the data provided by Arctic Gas to arrive at its conclusions.

> Arctic Gas' impact statement is the foundation of the report... without that assessment a lot of the conclusions Berger drew would be unfounded.

This considerably understates the differences in interpretation between Arctic Gas and the Commission.

Judge Berger had two main findings. First,pipeline construction across the northern Yukon to Alaska in the area crossed by either of the Arctic Gas routes was unacceptable on the basis of biological environmental considerations. Second,construction down the Mackenzie Valley should be delayed for ten years to give enough time for the native peoples of the region to prepare their social institutions for the pressure which development would bring. As part of this preparation,Judge Berger felt it was essential that the land claims of the native people be settled before any development should occur.

The clear loser in this decision was Arctic Gas. The Arctic Gas pipeline could never be built because it crossed the northern Yukon. This was the case even if the project could wait out the delay in the Mackenzie Valley. Therefore,the main argument which made the Arctic Gas pipeline unacceptable on any time scale was a biological one.

The Arctic Gas participants' comments on the report reflect this loss. Six Arctic Gas participants stated that Berger's assessment was not based on facts. For example here are the remarks of one scientist:

> I think frankly he deliberately distorted the truth... An issue in point is the decimation of the Porcupine Caribou Herd. Absolutely no evidence by any expert witness for any group would predict that...But Judge Berger personally came to the conclusion, and no expert witness before him came to it, therefore, I have no other choice but to come to the conclusion that he deliberately drew his own conclusions on evidence presented and disagreed with all the experts before him in some of the areas.

Another Arctic Gas witness told the same caribou story. In both cases, going beyond the evidence refers to going beyond the interpretations of the data made by the expert witnesses. A related charge, made exclusively by Arctic Gas scientists, was that Berger did not rely on the real experts when he made his decision. For example, the comments of another scientist:

> It's based highly on emotion. In terms of writing it's an excellent document. I mean the guy does have the gift to write. It's a well written document but it's not founded upon factual material at all. Like I say, he's taken a particular witness that didn't necessarily have any real experience in this area and applied more weight to his testimony than to the guys who actually had the in-depth knowledge. And that's what I mean when I say it's a crock of shit...We had our scientists on the stand. These guys who actually conducted the work and of course they had been cross-examined. And there would be somebody else that was supposed to be an expert in this area as well. Now this expert may have done little more than read a book on the matter, in a lot of instances had not conducted any original research whatsoever, in the North, but had an opinion. Now in most instances Berger gave more weight to that individual's opinion than he did to the scientist who had done the work for Arctic Gas.

This same story was told in various forms by the Arctic Gas scientists. Some of them were more explicit in labelling their work as scientific but, however it was explained, they presented a similar chain of reasoning with respect to Berger's rejection of their position.
The references to Berger as having rejected scientific expertise was a form of argument used only by the Arctic Gas scientists. The non-scientific Arctic Gas participants concentrated their criticisms on more general features of what they perceived as Berger's biases.

Arctic Gas participants argued that Berger was biased in two basically interrelated ways First, he was seen to have had preconceived ideas which determined his decision, and second, this bias was claimed to indicate that Berger used the environmental evidence to back up his opinions on social questions related to pipeline development. For example, here are two remarks by a lay person and a scientist. From the lay person:

> ...it was a waste of two years time and the taxpayers money to expound and scientifically justify an opinion that he had at the outset.

From the scientist:

> ...Because his major interest isn't the environment at all. His major interest is sociological concerns. And certainly everybody should be concerned about the natives. And he felt that he was protecting the interests of the natives up there. This is his whole background.... And this is exactly what you'd expect from him that he is protecting the interests, as he sees them, of the natives, and he has used environmental arguments where he felt

> he could further his interests. It seems to me that that's what it is. Certainly it's not a scientific document.

The multiple aspects of conflict between Berger and Arctic Gas are difficult to overstate. Berger not only constructed findings which made Arctic Gas lose the battle but he also disagreed systematically with almost every important feature of the Arctic Gas case. For example, Berger questioned: the need for northern development (see Chapter 6 below), the limits of the problem defined by Arctic Gas (see Chapter 8 below), the technical ability to build a pipeline (see Chapter 7 below), and the environmental reliability of industry (see Chapter 7 below). Berger's critique was comprehensive. In addition, Arctic Gas participants argued that Berger was actively hostile to Arctic Gas participants. Two instances of this direct conflict bear closer examination. One is substantive and the other concerns the independence and integrity of Arctic Gas witnesses.

First, there is Berger's reaction to the testimony of Les Williams, the chief engineering witness for Arctic Gas. Williams made a general statement on the ability to solve technical problems when he was cross-examined on the technical difficulties of pipeline construction (see Chapter 7 below for additional discussion). Williams stated that he did not see the pipeline construction problems as a "big deal" and referred to the technical achievements of space exploration in his remarks:

> In the present days when we have done so much, so many things with technology like putting men on the moon and a soft landing on Venus...
> (MVPI vol. 86 p. 13020)

Judge Berger reacted to this technological affirmation in a critical way:

> And you will appeal to the you know, to technology with a capital T, the man on the moon and so on, but... technology has had failures.
> (MVPI vol. 86 p. 13032)

At the conclusion of the hearings for that day, Berger went on at length to discuss the idea that technological solutions could be found for problems. As a counter to the image of successful problem solving, Berger referred to the differences between the moon landing and an economically motivated project. He pointed to the failure of the oil and gas industry to predict reserves as an indication of technical failure:

> ...I want to remind those present that the oil and gas industry told us five years ago that Canada had enough gas to last Canadians for three hundred years. That was based on the predictions of engineers and geologists and we're now told that we're facing a shortage this winter. That is a failure, it seems to me, of technology and it's that kind of failure that can occur and should be born in mind, side by side and along with the triumphs of technology.
> (MVPI vol. 86 p. 13058)

This interchange was pointed to by Arctic Gas participants as evidence of Judge Berger's unreasonable and aggressive stance. For example, one scientist described this interchange in the following way:

> So he took the time out to really read out a lecture to him on all the undesirable features of technological society, what a mess the world was because we built the bomb, and spend money in arms races, and did all of the rest of the thing. And Williams was very upset about it because Berger took all his frustrations of technological society out on this one witness and Williams just had to sit there and take it as being personally responsible for the mess the world was in because of technological advances, and he was very upset. I'm now going to make a medical judgement, it may or may not be true, but Williams had a heart attack after that and many of us feel that the harrassment of the Judge led to his heart attack.

These comments on the Williams-Berger interchange were indicative of the extent of conflict between Arctic Gas and the Commission on issues. It is clear that Berger was aggressive toward a witness on this issue. The Arctic Gas participants recognized this aggression and felt that they were unfairly maligned.

A second case of conflict between the Commission and Arctic Gas revolved around the credibility of the testimony given by Arctic Gas scientists. One passage in the Inquiry Report was referred to by two Arctic Gas scientists as an attack on the integrity of Arctic Gas witnesses. Here is the putatively offending passage:

> In view of the above, I cannot share the opinions of Arctic Gas and their consultants that the gas pipeline along the Coastal Route would have little detrimental effect on the Porcupine Caribou Herd. Rather, it is clear that the pipeline will have highly adverse effects on the caribou during the calving and post-calving period.
> Thus, it is not surprising that the caribou biologists - except those retained by Arctic Gas - have taken the position that no pipeline should be built along the Coastal Route through the calving grounds. (Berger 1977a,p. 41)

The affiliations of Arctic Gas scientists are here referred to as part of a description of the range of opinion. Further the words "not surprising" characterize the opinions of caribou biologists in general.
By implication,Arctic Gas scientists' views are "surprising" or illegitimate.

A thorough examination of Judge Berger's referencing behaviour, in the six pages of the report devoted to the discussion of caribou,highlight the use of the affiliations of Arctic Gas scientists as an indication of the credibility of their statements. Berger refers twelve times to the opinions of scientists who presented evidence at the Inquiry. In seven of these cases he agrees with the point being made. In all of these cases Berger does not mention the affiliation of the scientist to whom he is referring. Four of these seven references are to Arctic Gas associated scientists. For example, when Berger wishes to emphasize the importance of considering the Dempster Highway's impact on caribou and the need for controls he references to Jackimchuk, an Arctic Gas caribou witness, without mentioning his affiliation:

> Jackimchuk and other biologists highlighted the need to develop and implement controls over hunting along the highway to avoid this threat to the herd. (Berger 1977a p. 43)

In contrast, there are five instances where he makes reference to scientists with whom he does not agree. In <u>all</u> of these cases Berger mentions the organizational affiliation of the scientists. These negative references were all to Arctic Gas associated scientists. For example:

> ...both of the wildlife consultants retained by Arctic Gas, Banfield and Ronald Jackimchuk, testified that the project will not have a significant impact on the Porcupine Caribou Herd. This must be considered an optimistic view of the project. (Berger 1977a, p. 40)

The rhetoric of expertise is a complex topic which deserves a separate and extended treatment. However, in this brief analysis, it does seem possible to view Berger as using the affiliations of Arctic Gas scientists to undermine the credibility of their position. This image of the lack of credibility of paid advice ran counter to the rhetoric used by industry associated participants, where they emphasize the objective scientific nature of their research(see Chapter 3).

In summary, there was a great amount of conflict between Arctic Gas and the Commission. The attacks by Arctic Gas participants on the Commission in the hearings are mirrored by public confrontations with Berger on issues, and less directly, on the credibility of their case. In short the major line of conflict for Arctic Gas participants was that between them and the Commission. Quantitative evidence for this focus of conflict lies in the uniformly negative comments by Arctic Gas participants on the report. In contrast, Arctic Gas participants made three positive comments on the two environmental interest groups (see Chapter 4). For Arctic Gas participants the conflict was more clearly drawn with the

Commission than with the intervenors.

III Foothills and the Commission

Foothills participants were far less critical of the Commission than were Arctic Gas participants. They were also less united, with a broader range of comments. Foothills witnesses were split in their evaluations, with two "negative" and one "positive" comment. One Foothills witness characterized Berger as idealistic. Another expressed that he was "disappointed" with the Report. A third, however, stated that he agreed with the Report and thought that it was an eloquent document. A biological advisor with Foothills was so cautious in answering that it was difficult to decide on his position so he was classified as unclear. The two organization persons for Foothills, on the other hand, had very clear "mixed" opinions. Both of them praised the Report, with one of them pointing to the environmental section as agreeable. Both of these people then expressed reservations about Berger's social arguments. Here are some of the remarks by one of these participants:

> I think the people up there themselves are entitled to have the benefits, in quotation marks, of development, civilization, all those things that go with them. If they want them. I just don't think that you can screen any part of the world. You can screen small parts like the eastern slope or something, but you can't screen a whole people.

These comments by Foothills participants are best understood in the light of three aspects of their inquiry experience: their qualified win, their lack of experience with conflict in the hearings, and the lack of integration of Foothills scientists within the organization.

Foothills came out a qualified winner in the ruling. The major contender for pipeline development, Arctic Gas, had been eliminated from the play. The ten year construction delay in the valley was inconvenient, and perhaps fatal, but it did not in principle rule out the construction of the proposal. The biological argument had in effect been won. Their case was lost, in terms of immediate development, on the basis of a social argument (the need for land claims settlement). Foothills became, in time, a big winner. The Judge recommended that a more southerly route along the Alaska Highway might be more suitable for the movement of American Gas only, and Foothills won the approval from both the American and Canadian government for its Alaska Highway route (see Bregha 1979, Gray 1979).

The lines of conflict between the Commission and Foothills were not clearly drawn. It was not obvious whether Foothills participants should be disappointed with the Report. The mixed comments of the lay participants and the biological advisor can be seen to reflect this ambiguity.

In accord with this lack of clear official conflict, the experiences of Foothills biological scientists in the Inquiry were quite benign. There were no major criticisms made by the Commission of their biological testimony during the hearings. The one Commission lay person who commented on

Foothills made a negative remark by stating that their "impact assessment was just about zero". But, as with the disparaging views of Foothills by other Inquiry participants, this negative evaluation did not surface in the Inquiry. The Commission was, therefore, not a focus for conflict for Foothills scientists. Even Foothills scientists who were critical of the assessment of the Inquiry did not approach the wholesale condemnation which the Arctic Gas witnesses had for Berger's decision in their comments. The most damning charge made by a Foothills witness was that Berger was "idealistic".

Finally, Foothills scientists were not as well integrated within their organization as were Arctic Gas scientists (see Chapter 3). The forces for unity of perspective were not as strong within Foothills. This lack of cohesiveness is evident in the split in Foothills scientists' views, with one scientist making a "positive" remark.

IV The E.P.B. and the Commission

The E.P.B. was split internally in its assessments, and this split is evident in the comments of the E.P.B. participants who were interviewed on Berger's decisions. One of these witnesses was very critical of Berger, stating "... he used and misused information as he saw fit". The other stated that he was very pleased with the Report. The E.P.B. organization person complimented the decision and indicated that Berger's arguments, especially in relation to the North Slope, were extremely persuasive and had influenced his views.

The E.P.B. as an organization did not, strictly speaking, have an interest in the outcome of the Inquiry. It did not clearly win or lose in the decision, since it did not formally propose or criticize a proposal. E.P.B. participants were also not the focus of criticism by the Commission. E.P.B. involvement was well received and this is reflected in the three positive comments made by Commission participants. In short,the lines of conflict or agreement between the E.P.B. and the Commission were not clearly drawn. The differences among E.P.B. participants in their reactions to the Commission reflect this lack of a clear experience for the E.P.B. with the Commission. They also reflect the weak forces of integration within the E.P.B. (see Chapter 3 above) where E.P.B. participants developed their perspectives outside of the Board.

V. CARC, COPE and the Commission

CARC and COPE were clear winners in the Berger ruling. Both of these groups had presented a case which was in favour of the land claims of the native peoples and very cautious in relation to development in the region. One CARC organization person described the Berger Report in this way "If you read the Berger Report and you read our report you will realize that it is almost verbatim in the living environment" (see CARC 1976). A participant associated with the biological case of COPE commented "...from our point of view you couldn't have asked for the Report to be much different". CARC and COPE were also organizationally in debt to the Commission since they were provided with funds from the Inquiry to help them to present their case (see Chapter 2). Their relationship with the Commission was therefore one of co-operation. There was also however an identity of interest between the intervenors and the Commission. Evidence for this is provided by the migration patterns of Commission and intervenor participants. For example, Barry, a biological advisor for the Commission, appeared as a witness for COPE. In addition, Gamble, who assisted in the writing of the Report for the Commission, migrated to a position with CARC after the termination of the Inquiry.

Undercutting this consensus, four Commission lay participants made either "mixed" or "negative" comments on CARC. This criticism was centered on the effectiveness of CARC participation in the Inquiry. Here are some of the "negative" remarks of one of these participants:

> I was very disappointed in CARC. Again they had the same constraints of time and money but they were an organization that advised us that they had access to very superior personnel on very short notice and we made available to them very large sums of money to fund their inquiries, their studies, and I was really very disappointed in what they produced... If you look at the transcript of the Inquiry and the material that was filed before the Inquiry and say what did CARC provide, with the exception of some expertise on caribou, not much. You know they didn't, it seems to me, ask the pointed questions about most environmental matters. They provided very few witnesses, called very little evidence, except on the subject of caribou... I don't think we got our money's worth out of them...

These "negative" comments by Commission participants are not reciprocated by any of the intervenor participants. The disappointment of Commission participants was not a focus of conflict between CARC and the Commission. The extremely positive nature of the remarks by some of the intervenor participants is hard to overemphasize. For example, here are some of the comments by one CARC scientist:

> Well, it's just a, how shall I describe it, it's just such an enlightening and well written and educational document, extremely cleverly put together, both from a visual, picture, and a verbal point of view. I just can't compare it with the routine that we are seeing these days in environmental impact assessment. I just can't say anything about it other than good things about it.

CARC-COPE scientists were not, however, unified in their assessments of the adequacy of the Report. Some scientists were not quite as laudatory in their comments. For example, two scientists stated that Berger was good in their area of interest. However, two COPE scientists were unable to comment on the Report because they stated that they had either forgotten or just did not know what Berger's assessment had been. These scientists were only briefly involved in the Inquiry discussions. Their lack of knowledgeability is an outcome of the social organization of intervenor experts and stands in contrast to the involvement of Arctic Gas scientists.

VI Participants and the Commission

There are three main empirical points of theoretical interest which arise out of the above consideration of the subjective dimensions of conflict between interest groups and the Commission: first, that participants experienced conflict between themselves and the Commission; second, that this experience of conflict was not shared by all participants; and third, that the social organization of scientists is reflected in the patterns of scientists' evaluations of the Inquiry assessment.

The first point, on the existence of conflict between participants and the Commission, indicates the importance of the consideration of the relationship between the agents of an inquiry and the participants in an inquiry when the problem is an analysis of the disagreements among experts. Scientists not only disagree with each other within the structure provided by formal inquiries (Kantrowitz 1967, Green 1972) but they also interact with inquiries. This is an important focus for the analysis of disagreements between scientists when they occur within formal inquiries.

The second point, that the experience of conflict with the Commission was not shared by all participants, further undermines the image of a parallel structure in expert debates which is prominent in the literature. Some participants were winners and some were losers. Some participants were the subject of criticism by the Commission while others received financial support and encouragement. This difference in experience must be taken into account when analyzing the development and crystalization of opinion. This is dramatically evident in relation to Arctic Gas, where the extent of conflict they experienced with the Commission differs markedly with that of most other participants. The effects of this on opinion formation are explored below in Chapters 6 through 10.

The third point, that the social organization of scientists is reflected in the patterns of scientists' evaluations of the Inquiry assessment, is clearly seen in relation to COPE scientists. In this case, two of the five COPE scientists indicated that they were unable to make comments on Berger's findings since they were not familiar enough with them. This is a direct consequence of the pattern of social organization of scientists within COPE, where scientists who testified on behalf of COPE often had little involvement with the organization or the Inquiry. Arctic Gas participants contrast with this pattern, presumably due to their high degree of Inquiry and organizational involvement. As a result, there was a high degree of cohesion in their views. The internal disagreements on the Inquiry findings exhibited by the E.P.B. and, to a lesser extent, Foothills also reflect a weaker set of integrating forces within these organizations (see Chapter 3). This social organizational base to the opinion formation of participants is examined in more detail in Chapters 6 through 10 below.

CHAPTER 6

ASPECTS OF THE DEBATE EXTERNAL TO BIOLOGY (I): THE DESIRABILITY OF NORTHERN DEVELOPMENT

I The Internal/External/Translation Distinctions

In this and the next three chapters, I examine the opinion differences of participants in the Inquiry on a range of factors related to the assessment of the impact of pipeline development on biological features of the environment. I demonstrate that opinion differences are complex and multifaceted. In this chapter, I show that scientists' assessments are related to their general attitudes on development.

There are three major categories I use to structure this discussion: "internal", "external", and "translation". A major distinction which is made in the analysis of the development of science is between accounts which emphasize the "internal" development of scientific ideas within a scientific community, and accounts which accentuate the "external" pressures of society and culture in the development of scientific ideas (see MacLeod 1977).
I have taken this external/internal distinction as a classification scheme for the analysis of the opinions of participants in the Berger Inquiry biology discussions.

Internal, in this sense, refers to issues which are clearly biological in nature. In Chapter 9 I discuss the debate over the relative fragility of arctic ecosystems and species to disruption as an "internal" issue. "External" refers to participants' opinions on matters which are commonly identified as outside of the province of natural scientific debate. Three chapters in this study concentrate on external factors. This Chapter, Chapter 6, concentrates on participants' general opinions on the desirability of pipeline development in the Mackenzie region. This discussion of "political" or public policy attitudes is supplemented by a consideration, in Chapters 7 and 8, of participants' opinions on various features of the definition of the pipeline event. For example, it is shown that participants differed over whether they considered the single gas pipeline or the multiple possible developments in the region as the legitimate object of analysis.

The third concept, "translation", comes from the internal/external distinction and refers to the action of interpreting or translating the significance of science for practical action. Chapter 10 concentrates on the translation issue of how recognized uncertainty is interpreted as having consequences for action. It is shown that, participants not only disagree over the extent of uncertainty, but they have different interpretations of the significance of uncertainty.

I am not implicitly suggesting, in this analysis, either an internalist or an externalist account of the development of ideas within biology. Nor am I implicitly arguing with this analytic separation that scientific issues are in principle separable from other factors in public policy debates. I am simply using this distinction to isolate one facet of the Inquiry debate. The relationships of various factors with one another is a topic pursued in this study.

II Political Attitudes and Expert Opinion

The political interpretation of conflicting expertise has two major variations (see Chapter 1 for details). One, exemplified in the work of Gilpin (1962), is that scientists agree on scientific questions but disagree on politics or public policy issues. The other, most clearly seen in the work of Nelkin (1975) and Mazur (1973), is that public policy factors influence scientific reasoning.

The first position is a relatively easy argument to support or disconfirm. If scientists agree on the scientific issues, as Gilpin suggests in his analysis of the test ban debates, and disagree on political ideas, then it is politics about which they disagree. The second position is far more complex and less clearly established. Scientists are said to disagree on political and scientific issues and it is stated that political ideas are important to the formation of scientists' ideas. This argument is quite speculative. For example, Mazur does not present evidence for the influence of political attitudes on scientific reasoning. He simply infers it by association:

> If an expert may reasonably take one of several positions on a technically ambiguous point, then we should ask why some experts take one position while other experts take another - often opposing position. One's interpretation of ambiguous data is often tied to one's position on the innovation about which the controversy exists. Thus, since a "threshold" radiation dose-affect curve is more congenial to the realization of the nuclear power programme than a "linear" curve, it is not surprising that the proponents of that programme are more likely than critics to believe that the "threshold curve" is the valid one. (1973 p. 258)

Although it may be the case that a particular scientific position is associated with a particular general attitude on the public policy issue at hand this association does not indicate the direction of influence. The argument that this association points to an influence on scientific reasoning by political commitments <u>assumes</u> the primacy of political motives.

Some writers have argued that scientists have used political or public policy arguments to further their scientific interests. For example, Greenberg demonstrates that the national interest of the United States and the competition with the Soviet Union was used by American physicists to argue for high energy accelerators which would keep pace with the Russians (Greenberg1967, chapter 10; see also Mulkay 1976). Although it seems possible that,in the case of conflicting expertise,political motives may be important to the reasoning of scientists, this should not be assumed to be the case simply by association. Other motivations are possible.

For example, it is possible that scientists with an interest in the preservation of a species which may be affected by development may use a political argument to reinforce their "scientific" interest. This study considers the possible motivations of the experts involved in the disputes.

The beginning of this analysis must, however, be the association between various components of participants' attitudes. This is begun in the present chapter with the consideration of participants' opinions on the desirability of northern development. In the discussion below, I start with a consideration of the public debate, including the findings of the Commission. This is followed by a consideration of the interview data.

III The Public Debate on the Desirability of Development

Judge Berger utilized a variety of non-biological arguments in building a case against pipeline development. Berger's social assessment emphasizes the need for a settlement of native land claims and a moratorium on development for ten years so that native peoples can prepare their social institutions for any development which should occur at that time. As part of Judge Berger's appraisal of northern society and its socio-economic needs, he states that the strength of the renewable resource sector of the native economy is very underrated. and that any development should not undermine this economy. In addition, Berger downplays the importance of the employment which would be generated by pipeline related activities. He states that the intermittent wage employment, which pipeline development would offer, would tend to undermine the traditional economy and create unemployment and thus escalate social problems:

> ...when the native people are made to feel they have no choice other than the industrial system, when they have no control over entering it or leaving it, when wage labour becomes the strongest, the most compelling and finally the only option, then the disruptive effects of large-scale, rapid development can only proliferate. ...rather than solving the North's economic problems, it may accentuate them. (Berger 1977a.xxi)

On a broader level Berger deemphasizes the Canadian interest in a pipeline by accentuating the American interest in establishing an energy corridor from Alaska. In this characterization, Berger outlines how the need for a pipeline is situated in the United States and not in Canada (Berger 1977a xxi). In accord with this comment, Berger downplays the importance of northern resource development to Canadian society during his discussion of the value of wilderness:

> ...it would produce no more than a marginal - perhaps even an illusory - increment to our material well-being. But this argument (for development) would apply to northern wilderness areas only if there were no other way in which, and no other area where, man could satisfy this urge. This is manifestly not the case.
> (Berger 1977a,p. 31).

The question of wilderness is another issue which contributes to Berger's general attitude towards pipeline development in the north. Berger discusses the importance of environmental values and how the existence of wilderness is important to these values:

> The value of wilderness cannot be weighed in the scale of market values. It is a national heritage. Many who sense change everywhere recognize that our northern wilderness is irreplaceable.
> (Berger 1977a.p. 30)

Berger proposes in his report that a wilderness area be established in the northern Yukon and that all industrial development should be prohibited from occurring there.

Berger's attitudes towards northern development therefore run clearly against pipeline activity. Development is stated to be: detrimental to the native economy and social structure, not needed by the Canadian south, and harmful to the preservation of wilderness in the northern Yukon.

General attitudes on development do not appear with any great frequency in the transcripts of the Inquiry in the sections which are designated as dealing with the biological impacts of pipeline development. Socio-economic arguments did surface indirectly when evidence was presented on the importance of animal populations to the native economy. This was done primarily by non-industry participants (see MVPI, vol. 136, pp. 103-5 for this relation to fish). The social significance of these biological factors was not, however, elaborated by these witnesses.

General attitudes towards development entered the testimony of biological witnesses most directly in the caribou debates. One witness, Dr. Bergerud, outlined how he was against the development of the arctic:

> I question the wisdom of the current rapid development of the north, tampering with largely virgin ecosystems and the continued over-exploitation of the non-renewable fossil fuels. I belong to the doom and gloom school of ecologists who believe that man's continued existence on this planet requires a drastic change in life style and preservation of our remaining ecosystems. (MVPI.vol. 110,p. 16744)

Although this witness made statements of this kind on his general attitudes towards development,it is difficult to assess the extent to which these attitudes may have affected his biological opinion. Bergerud explains that "The porcupine herd can remain healthy only in an intact ecosystem" (MVPI.vol. 110.p. 16746). His concern for the system does not, however, relate to pipeline development in isolation.but extends to the idea of further development. Indeed,at one point Bergerud states that he agrees with Jackimchuk that a gas pipeline would not be harmful (MVPI vol. 110 p. 16748). His concern for the caribou is predicated on his view of northern development activities which goes beyond the building of a gas pipeline:

> A buried gas pipeline is, in my view, only the first step. Once economic penetration starts it accelerates and feeds on itself. (MVPI,vol. 110,p. 16747)

Perhaps Bergerud's opinion of the imperatives of modern industrial society influenced his opinion of what would occur in the region.and this in turn caused him to oppose pipeline development (see Chapter 7 below).

Bergerud's concern for the maintenance of the northern Yukon, independent of major industrial activity.is mirrored in the comments of Lent, another CARC witness on caribou. Lent and Bergerud differed markedly on their assessment of the ability of caribou to withstand disturbance. Bergerud felt that caribou could adapt to disturbance if man behaved properly and did not overhunt or harrass them during sensitive periods, notably calving. Lent,on the other hand,argued that caribou were a wilderness species which could not tolerate contact with man (MVPI vol. 106 p. 16181). This feature of Lent's argument makes the preservation of wilderness essential. The question of wilderness does not, however, stop here.since Lent advances the preservation of wilderness as an end in itself:

> Any industrial exploitation must be avoided because of the inevitable undesirable impacts on the aesthetics, scientific and wilderness values. (MVPI,vol. 110 p. 16182)

The relationship between wilderness as an end in itself,and as a necessary condition for ensuring the survival of the caribou are intertwined. Like Bergerud, Lent is concerned about future industrial development. He refers to the attempts within the United States to designate the north east portion of the State of Alaska a wilderness area, and he is concerned that building a pipeline across this land would disqualify it from getting this status. This would then open this area for further development (see Chapter 8). Wilderness can, therefore, be seen as a goal for Lent,but it is a goal which is very much intertwined with his concepts of what would follow without the official wilderness designation and his concept of caribou as a wilderness species.

Calef, another caribou witness for CARC, also mentioned a concern for wilderness designation in his testimony (MVPI,vol. 106 p. 16225), and published an article calling for the establishment of a wildlife range in the Northern Yukon (Calef 1974). Industry witnesses did not highlight wilderness as a goal in their testimony. Hemstock, the policy witness for Arctic Gas in the environmental phases of the hearings, advanced that the pipeline was not impinging on "wilderness values" because the area had already been disturbed (MVPI,vol. 99 p. 15052).

In the public record of the Inquiry hearings there was only, therefore,one biological witness who mentioned his socio-economic attitudes in his testimony. Another non-biological factor, the desirability of wilderness, was also mentioned by other intervenor witnesses. It is, however. unclear how these factors may have affected the assessments of participants. This is compounded by the fact that the concept of wilderness is tied to concepts of the dependence of some arctic animal populations on wilderness and the idea that further development will follow if a pipeline is built.

IV Arctic Gas Participants on the Desirability of Development

In the interviews, participants were asked the question:

> What do you think of the whole idea of a Mackenzie Valley pipeline? Is it a good or a bad thing for the north? Is it necessary?

Replies to this compound question were combined with statements on northern development which participants offered at different points in the interview. Participants' comments on development are summarized in Table 8. Participants' comments are classified as "FOR", "MIXED", and "AGAINST". FOR signifies attitudes which are in favour of development. "MIXED" indicates remarks which are mixed in relation to development. "AGAINST" refers to comments which are critical of pipeline development.

TABLE 8

Attitudes of Scientists Towards Development in the North by Organization *

Scientists by Organization

General Development Attitudes

	Arctic Gas	Foothills	E. P. B.	CARC	COPE	Comm.
For	5	3	1		1	
Mixed					1	1
Against		1	1	3	3	
TOTALS	5(6)#	4(4)	2(2)	3(4)	5(5)	1(2)

*Based primarily upon responses to the question:

"What do you think of the whole idea of a Mackenzie Valley Pipeline? Is it a good or bad thing for the north? Is it necessary?"

the number in brackets is the total sample size

All of the Arctic Gas participants who commented on development stated that they were in favour of it. Two of the Arctic Gas witnesses stated that the pipeline was good for Canada but not necessarily for the north. Both of them stated, however, that impacts could be mitigated. Here are some of the comments of one of these witnesses where he demonstrates the importance of southern over northern interests even in terms of the adequacy of the mitigation:

> For the people of the north? No. ... But for the people of Canada, yeah. it would be a good thing. You only have to look at our eighty cent dollar and say holy smokes how can we get some cash into this country ... I think they (social impacts) could be limited to some acceptable level. Acceptable to who I'm not sure. To me probably because I wouldn't have to live there all year 'round

Other scientists outlined the need for industrial development and the need to get Canadian gas from the Arctic to southern markets. The social cohesiveness of Arctic Gas scientists (see Chapter 3) is accompanied by a uniform set of public policy views.

V Foothills Participants on the Desirability of Development

One Foothills scientist was the only industry participant with a comment against development This person stated that he was opposed to pipeline development:

> Strictly on a personal level, no I would not. Of course that has to be qualified insofar as I live in a house that has to be heated just like everybody else.

This person elaborated his economic argument by stating that a pipeline was not needed now. This witness went on to question whether the pipe would be best in the Mackenzie Valley,but stated that a pipe could be built "from one place in the north to some place in the south" with an acceptable impact.

The other scientists made comments which were favourable toward development. One remarked that the pipeline was needed to maintain our standard of living.. He also stated that the pipeline would probably do more harm than good to northern society. In a later comment, however, this participant explained how he thought that northerners could survive the rapid changes and he referred to his own experience in a small community which had expanded rapidly: "We somehow lived through it and why can't they do it up there?".

The witness who expressed views which were against development was the witness who explained how there had been some tension with his client. This person also intimated that his public testimony might not have been his true judgement,but that he had decided that it was worth it to exchange a short-term compromise for long-term influence (see Chapter 3). The relative lack of integration of Foothills scientists as opposed to Arctic Gas scientists is reflected in this divergence in political views between this scientist and the other Foothills participants.

VI E.P.B. Participants on the Desirability of Development

Board participants' attitudes towards development paralleled their conflicting impact assessments. The pro Arctic Gas witness stated that the renewable resource sector of the northern economy had been much overrated by Berger,since it was not biologically productive enough. The conclusion which was drawn from this by this participant was that industrial development was needed to provide employment in the Mackenzie region.

The scientist who was critical of Arctic Gas, when asked directly about whether pipeline development would be a good or bad thing,stated "I haven't any idea". This person was, however, classified as having attitudes which ran against development because of his repeated statements on the value of wilderness and the necessity to set aside the northern Yukon as a wilderness preserve:

> ...the Arctic Wilderness Range Society...has asked Canada to set aside that huge area that's now been sequestered as an arctic wilderness range, adjoining the American one, so that there would be one great range almost from just east of Prudhoe bay all the way across to the Mackenzie Mountains It would be a fabulous area. And both these routes were going to go through it... To me they are both unacceptable.

VII CARC-COPE Participants on the Desirability of Development

Only one CARC-COPE participant, a COPE scientist, displayed attitudes which were favourable toward development. This person de-emphasized the severity of social impacts:

> I don't think it would have the serious impact that everyone thought it would.

To back up this assertion,this person pointed to past developments in the region and their lack of impact:

> I think the only sociological impact is that there are a few descendents of those guys around in some of the native communities.

This person also stated that the pipeline development was needed on "economic grounds".

Another CARC-COPE participant, also a COPE scientist, was classified as having a mixed opinion. This person stated that he thought that development would have been disruptive of northern society. This witness continued, however, to outline how he thought that there was a need for wage employment since:

> ...for some time the concept of living off the land hasn't been realistic for more than a fraction of the population.

In addition, this person stated that he thought that it was not possible to shelter native peoples. He commented that eventually there would be a world culture. This world culture was advanced by this witness as an alternative to fragmented group allegiances and perpetual conflict.

All six of the remaining CARC-COPE scientists who made comments towards development indicated that they were against development. These scientists made a wide range of comments Three of them pointed to the disruptive effects pipeline development would have on northern society. One witness commented that development was being pushed too fast. Another witness remarked that he was skeptical about the forecasted need for a pipeline:

> A colleague of mine was just in this morning to say did you see the bit about wanting to sell gas to the U.S.A. for the next few years? etc.. because suddenly we have too much... If it is demonstrated that in fact we require within X years, beyond a doubt, a supply of gas within our own country, then I would tend to think a pipeline takes on a great deal more importance than otherwise.

A different scientist outlined his basic disillusionment with the "state of the world" in terms of its wasteful ways, and stated that the resources could be left in the north until they were really needed. Another witness elaborated how he always preferred a southern route along the Alaska highway because this area was already disturbed. This would leave the northern Yukon in a relatively wilderness state. This person also questioned the Canadian need for a pipeline by pointing to the lack of proven reserves in the Delta:

> We have always been talking about American gas to American consumers... so if that is what we are talking about let's let the Americans get it to their destination with the minimum mileage or impact on Canada and just following the Alaska Highway seemed to make so much sense to accomplish that.

Another scientist also highlighted the American interest:

> I don't see any reason for us to build a Mackenzie Valley pipeline and bleed off our resources to the States, which is just what would happen.

CARC-COPE participants were similar to industry participants in that their attitudes towards development were for the most part in line with their organizational affiliation. Their attitudes towards development were consistent with their biological assessments. There are, however, two exceptions to this trend. One witness made favourable remarks towards development and one had "mixed" attitudes. This spread is further indication of the structural organization of the environmental intervenors where they were an alliance of various compatible points of view.

VIII Commission Participants on the Desirability of Development

Commission participants either made "mixed" or "against" remarks. One Commission witness, the only witness who made general remarks on development, was classified as having a "mixed" opinion. This person stated that there was a surplus of gas from Alaska so that the pipeline was not needed. In addition this witness explained that he thought that native society should not be ghettoized. This person also commented that native peoples do more damage to a species about which he was concerned than development would do.

IX Summary

The data demonstrate a strong polarization among experts on public policy matters The possible influence of these opinion statements must be considered in light of an analysis of other components of scientists' attitudes. This is done in the next four chapters below. One major point does, however, emerge at this juncture in relation to scientists' comments on northern development. This is. that the social organization of scientists is reflected in the pattern of scientists' development statements.
The organizational integration of Arctic Gas scientists is matched by a unanimity in pro development attitudes. In contrast the weaker forces of cohesion in the other organizations fostered dissenting views (Foothills, COPE) or internal cleavage (E. P. B.).

CHAPTER 7

ASPECTS OF THE DEBATE EXTERNAL TO BIOLOGY (II): TECHNICAL AND BEHAVIOURAL FEATURES OF THE DEFINITION OF THE PIPELINE EVENT

I Definition of the Pipeline Event

In Chapter 6 above, I demonstrated that participants' general attitudes on the desirability of pipeline development are associated with their impact assessment. This "external" factor, however, is not necessarily related to the assessment of impact. It is possible for participants to have general development attitudes which do not parallel their particular assessment of the impact of pipeline development. This was clearly demonstrated above to apply in the case of two COPE scientists.

In this chapter, I deal with factors "external" to biology which are more directly tied to the assessment of impact. The object of assessment is central to an analysis of impact. Different pipeline problems can lead to different evaluations of impact.

The importance of problem definition has been recognized in the literature. For example, Nelkin has argued this in terms of the behaviour which surrounds a technical question:

> ...prediction may also rest on broad social and political assumptions. Judgements about technologies requiring continual political control (eg., nuclear waste management) depend as much on assumptions about long-term political stability as on facts about available technologies. (Nelkin 1977)

Evidence of the importance of the behavioural aspects of a problem for the prediction of impact is provided in the work of Gilpin on the test ban debate. Gilpin argues that scientists agreed on the technical questions of how sensitive the methods were for the detection of clandestine nuclear explosions. Scientists agreed that the effectiveness of detection procedures, although high, was not 100%. Some scientists reasoned that the possibility of detection was adequate to deter the Russians.since they would not risk getting caught through fear of the consequences, therefore. the test ban was technically feasible. Other scientists reasoned that,if there was a chance of avioding detection,the Russians would risk it to get a lead on the United States, therefore a test ban was not technically feasible. Predictions about the behaviour of the Russians are a crucial aspect of this assessment (Gilpin 1962,chapter 9).

In this chapter, I discuss two major aspects of the definition of the pipeline event which appear to be related to the assessment of impact to biology. First,I examine the issue of the technical ability to build the pipeline. Second, I investigate the issue of whether industry is environmentally reliable. A third definitional issue, whether the pipeline alone or a corridor of development is the legitimate object of assessment, is examined in Chapter 8 below.

II The Ability to Build: The Public Debate

The pipeline companies stated that the pipeline would be constructed in a certain way. For example,Arctic Gas stated that the pipeline would be built in winter across the North Slope from a road of compressed snow. These snow roads would minimize terrain damage, reduce the requirements for borrow materials, and eliminate the access which would be created by a permanent road. The winter construction timing would also avoid the calving and concentration of the Porcupine Caribou Herd which occurs on the North Slope in the late spring and early summer. In addition, the pipeline was to be chilled in its northern sections so that it would not melt the permafrost in which it was buried. Permafrost,when it melts,does so quite dramatically, and depending on the water content and type of soil, the ground can become quite unstable and turns into mud. This is a perpetual terrain problem in arctic construction. The chilling made it possible for the pipe to be buried and this would avoid the barrier effect and the expense which an above ground pipeline would create.

By the end of the Inquiry,there was considerable doubt in the view of the Commission over the technique of burying a chilled pipeline. In the northern sections of the pipeline the terrain is almost totally permafrost but as the route continues south there are large areas of intermittent permafrost. At a certain point,where the permafrost ceases to be the dominant form of terrain,the pipe would no longer be chilled. When the chilled pipe runs through unfrozen ground, as it does in the areas of intermittent permafrost, it freezes the ground water around the pipe. The ice which then builds up around the pipeline exerts pressure which tends to heave the pipe out of the ground. This is known as frost heave. The solution to the frost heave problem was to place enough weight, by way of fill and concrete collars, to counterbalance the upward pressure. The calculation for the amount of overburden necessary was based on theoretical calculations and the results from a test site operated by Arctic Gas. The frost heave debate had a rather dramatic conclusion in that,at the very end of the Inquiry,Arctic Gas informed the Inquiry that the experiments had produced faulty conclusions due to a flaw in the testing equipment (MVPI,vol. 195 p. 30584). This flaw had been discovered when the National Research Council attempted to replicate the experiments. The new pressure calculations meant that the original construction techniques were not suitable and Arctic Gas introduced other measures, including heat tracing and temperature regulators,as solutions (see Berger 1977a,chapter 3).

Judge Berger was critical of the pipeline proposals for the difficulties which the frost-heave issue presented:

> Arctic Gas and their engineering consultants have discussed their plan to refrigerate and bury the pipeline with optimism and assurance. I think, however, my approach should be conservative. In my view, the controversy and uncertainty that surround the subject of frost heave and its control reflect adversely on the proposals brought before this Inquiry by both companies. (Berger 1977a p. 18)

An additional area where Berger had reservations with the construction proposals was on the issue of construction scheduling across the North Slope. Arctic Gas stated that the North Slope construction would be accomplished from snow roads, roads made from compressed snow. Berger expressed basic reservations about this technique,focussing primarily on the availability of snow for the construction of snow roads on the North Slope. Although it is very cold,there is little snow on the North Slope. Snow has to be manufactured. The difficulty for Berger of this proposal stemmed from the untried technology which is involved:

> The snow-making equipment to be used on the Arctic Gas Coastal Route does not yet exist - we were simply shown an artist's conception of a large vehicle, with a big compressor and up to six snow-making nozzles. (Berger 1977a,p. 24)

Justice Berger also remarked on the time element which was involved in the construction of snow roads,questioning whether there would be adequate time in all areas the pipeline would cross for the road construction. Winter frost must penetrate the unfrozen ground on the tundra surface before activities begin, and this penetration varies locally with wet areas taking longer than dry. In addition, the shut-down for construction must be timed with the thaw which can vary from year to year. If the road construction was too short, then schedules could not be met and additional construction time in the summer or another year would be required. This would increase the impacts (Berger 1977a, p. 24).

Justice Berger also questioned the productivity of winter construction, stating that there was no precedent for such an undertaking, so that productivity estimates could not be reliable. As part of his productivity criticisms, he pointed to the innovations in machinery whereby the ditcher which was to dig the trench for the pipe "... is still being developed and so are some of its components such as the ditcher teeth... No prototype has yet been built." (Berger 1977a, p. 25)

The conclusion which Berger drew from his characterization of these construction uncertainties was that the pipeline would possibly not be able to be built in winter and that a permanent road would be needed:

> I am not confident that the pipeline can be built in accordance with the present plans and schedules. Particularly, I am concerned that scheduling problems in the Northern Yukon could lead to a need for summer construction and a gravel road along the Coastal Route. The environmental impact of this change would be severe. (Berger 1977a, p. 27)

The question of the technical ability to carry out pipeline construction related tasks surfaced at various points in the biological discussions in the hearings. For example, Lent, a caribou witness appearing for CARC, gave a fairly detailed account of the construction difficulties which occurred in Alaska with the oil pipeline:

> My experience in Alaska in the Arctic and sub-Arctic suggests that tight schedules, especially those involving winter operations, are by and large a fiction. (MVPI, vol. 105 p. 16141)

This testimony was directed toward the construction across the northern Yukon. Another area where technical concerns were expressed by biologists was in the Beaufort Sea testimony where the adequacy of the oil spill cleanup technology was questioned (MVPI, vol. 121).

The two industry proponents and the E. P. B. were questioned by John Bayly, counsel for COPE, on the assumptions in their impact assessment. Bayly outlined a series of assumptions relating to what the pipeline event would be like and asked these witnesses to state whether they accepted these assumptions when they were making their assessments of impact (see MVPI vol. 95 p. 14425; vol. 99 p. 15139; vol. 107 p. 16365). Several of these assumptions related to the technical features of the pipeline and several related to the behaviour of participants in the construction. The behavioural assumption are discussed in the next section below. Bayly asked participants whether they assumed: that the pipe could built the way it was planned, that the engineers had the "knowledge and ability" to solve problems should they occur, and that winter construction techniques will work on the North

Slope making a permanent road unnecessary. The Foothills, Arctic Gas, and E. P. B. biological witnesses agreed to these assumptions.

One of the clearest instances where attitudes towards the technical ability to build came forward in the hearings was during the cross-examination of Les Williams which I referred to in Chapter 5. Les Williams was the principle engineering and construction witness for Arctic Gas. Williams expressed a confidence in technology to solve problems as indicated by the accomplishment of landing men on the moon (MVPI vol. 86 p. 13020). Judge Berger responded to this in very critical terms, indicating that technology had had failures (MVPI vol. 86 p. 13032, p. 13058).

In summary, the technical ability to build entered the debates at strategic points and became a focus for conflict. The technical ability to execute the pipeline as planned figured prominently in relation to the arguments about the impact of pipeline development. For example, the North Slope construction plans and schedule affected the assessment of impact on caribou, and the effectiveness of stream crossing techniques was tied to an assessment of impact on fish populations.

III The Ability to Build: The Interview Data

To discover participants' attitudes on the technical ability to build the pipeline, they were asked the question "Could it (the pipeline) be built?". The responses to this question are displayed in Table 9. Scientists responses are coded as "can build", "cannot build" or "mixed view". Only three scientists (and one lay person) stated that it could not be built. This finding is confounded however by the public statements of participants on technical problems which are also paralleled by remarks at other points in their interviews. I argue that this indicates that the concept of technical competence is a very firm one in modern society at a very abstract level but that the manner in which this abstraction is applied can result in very different assessments of technical competence in specific cases.

The importance of the assumption of the ability to build the pipeline to the assessments of Arctic Gas participants is best illustrated by the comments of one of the witnesses:

> I had always assumed that it could be built according to schedule, and I had to make that assumption because my own assessment was dependent upon that. I had no reason to believe that it couldn't have been...

Other Arctic Gas scientists stated that it was possible to overcome technical problems, including the frost heave issue. The comments of scientists were generally very concrete, referring to the project itself and not technical capabilities in general. In contrast one scientist came forward with a very

TABLE 9

Scientists on Technical Ability by Organization *

Scientists by Organization

Technical Ability	Arctic Gas	Foothills	E. P. B.	CARC	COPE	Comm.
can build	5	1		2	1	
mixed view		1		1	2	1
cannot build		1	1		1	
TOTALS	5(6)#	3(4)	1(2)	3(4)	4(5)	1(2)

*Based primarily upon responses to the question: "Could it(the pipeline) be built?"

the number in brackets is the total sample size

strong comment on the general ability of people to solve technical problems, using the landing of the men on the moon as an analogy:

> The analogy I always use, and it sounds rather purile but when you think of it I think it's very true; if we can send a man to the moon we can build a pipeline through the permafrost.

The Williams' interchange with Justice Berger surfaced in the comments of one scientist in some detail. This person related how the Williams' testimony provided Berger with an opportunity to display "his anti-science bias". This person's characterization of Berger's reaction to Williams bears extensive quotation:

> Well Berger, it really annoyed him tremendously... You have to go back to... the basic conflict between technological society and humanistic society, and Berger is an outstanding example of a humanist, and he was very annoyed at this clearly technological answer. Here's somebody saying technologists can do it. So he took the time out to really read out a lecture to him on all the undesirable features of technological society, what a mess the world was because we built the bomb, and spend money in arms races, and did all of the rest of the thing. And Williams was very upset about it because Berger took all his frustrations of technological society out on this one witness and Williams just had to sit there and take it as being personally responsible for the mess the world was in because of technological advances, and he was very upset. I'm now going to make a medical judgement, it may or may not be true, but Williams had a heart attack after that and many of us feel that the harassment of the Judge led to his heart attack.

These remarks demonstrate the importance of the technical ability issue to the debates and how, during the course of the Inquiry, conflict crystallized on this issue for some participants. When discussing the media aspects of the Inquiry, three Arctic Gas participants, including the witness quoted above, referred to a collusion between the C.B.C. and Judge Berger and cited the Williams episode as a prime example. According to these Arctic Gas participants, the Williams interchange had not been filmed. However, on a subsequent television news cast, Berger appeared in what purported to be a live recording of his response to Williams. This, they claimed, had been restaged by Berger and the C.B.C. . This account of the restaging surrounds the technical ability issue and this underlines the importance of this issue as a focus of conflict for Arctic Gas participants.

Three scientists made clear "cannot build" remarks. One Foothills scientist made a negative comment on technical ability. This scientist stated that it wasn't reasonable to construct on the North Slope in winter.
This construction feature applied only to Arctic Gas since Foothills did not plan to cross the slope.

One E.P.B. and one COPE scientist also made "cannot build" remarks. Here are the comments of one of these scientists:

> They said they were going to build the pipeline along the north coast in the winter time. We told them they couldn't do it. The evidence from Alaska was that you can't build that kind of pipeline in that country in the winter time... So we felt the company was naive...

In the case of the E.P.B. scientist, this negation of the ability to build contradicts the public testimony of Board participants, where they accepted Bayly's technical assumptions (MVPI, vol. 107 p. 16365).

Three of the CARC-COPE scientists who made interview comments were classified as "mixed." These participants made "can build" remarks but in some of their comments, both in the hearings and in the interviews, they questioned the <u>particular</u> technical capabilities in relation to their areas of interest. Three of the five witnesses who made "can build" comments exhibited this pattern. For example, here are some of the comments of one witness:

> ...I assume that with suitable studies the problem could be overcome, but as I say, the engineers assured us of that, but I'm not aware of any work that has gone on since that point in time.

The other witnesses did not pair the ability to build with the actual capabilities quite so closely. They simply questioned the technical features in relation to their biological impact area as part of their discussion of their opinions but, when asked about technical ability in general, answered in the affirmative.

The abstract nature of these"can build"responses is important.

For example:

"Oh sure. I haven't got a clue but I assume they could."

Another scientist,who did not qualify his"can build"response,also exhibited this detached, perhaps indifferent, style of comment:

> I don't know. If they put it forward as a realistic proposal I assume the engineers had done their studies.

In contrast,two of the CARC-COPE witnesses made"can build" comments referring to specific features of the pipeline. For example:

> I don't have a strong feeling for that, I think it could. I'm not one who says that engineering can solve everything but... If you spend enough bucks you put in either temperature regulators or enough concrete that it's immovable. But I'm not a pipeliner. A pipeliner would say well that is too much money so we can't build it.

This person made repeated comments concerning the economic viability of the pipeline and had consistently accentuated its uneconomic features.

Only one lay CARC participant stated that it could not be built,but this participant qualified his opinion by referring to the abstract ability to solve engineering problems:

> I don't think that it could be built in the way and in the time frame that was presented, and I think the time frame is crucial. I think it probably physically could be built... The engineers, if you give them enough time, and enough money, they will do anything, and I think they probably could build a pipeline too. I don't think it is good but it could be done.

Only one CARC-COPE scientist made a clear "cannot build" remark. This is interesting in that a component of the criticism of the Arctic Gas case by environmental intervenors was the inability of Arctic Gas to execute the project as planned. The question, however, which participants were asked was a general one, "Can it be built?" and the replies from CARC-COPE participants were by and large general. This abstract "can build" referencing pattern suggests that intervenor participants did not rely on general concepts of technical problem solving ability to formulate their assessments of impact. On a concrete level, six out of nine non-proponent scientists questioned technical ability in some way.

The Commission scientist with the mixed remark was the only participant to use an abstract concept of technical incompetence. On the one hand, this participant stated when asked the main question that he was confident that the pipeline could be built. On the other hand, in another part of the interview, this person voiced skepticism of the technical ability to solve problems:

> ...we have problems with stack emissions and things like that... That's caused by the fact that engineers proceeded with caution on certain things. They weren't sure of the effects and they thought they had them all covered. And guess what, there are more effects there than they really know about.

What the pipeline project would be like is important to the assessment of impact. For example, whether the pipeline could be built in winter from snow roads along the coast,or in summer from a permanent road,is a crucial factor in the assessment of the pipeline's impact. This has been shown to be important to the reasoning of many participants in the public record and interview responses.

IV <u>The Ability to Build: Summary</u>

On a general level,the question of technical ability was questioned by only one participant. This general consensus on the idea of technical ability was used by groups of participants in very different ways. Arctic Gas participants, when they replied in an abstract way, used technical competence arguments to buttress the uncertainties of their position. The general idea of technical competence entered their arguments as a component of their case. In contrast, intervenors often admitted the general ability to solve problems but did not apply this principle to the pipeline proposals in their area of concern. General concepts of technical competence do not, therefore, appear to have affected intervenor participants' characterization of the event, since technical factors did appear in particular instances as problems in their assessment of impact. This suggests a rhetorical usage.

V The Environmental Responsibility of Industry: The Public Debate

In mapping out what the pipeline would be like, participants made arguments not only about technical capabilities but also about what the behaviours of people involved in the project would be. The project itself is the product of technical ability and how these abilities are translated by the behaviours of the people concerned. Below, the behavioural component of the pipeline event is discussed. It is shown that participants' assessments of the behaviour of industry is a crucial feature of their image of the pipeline event.

Judge Berger refers to the behaviours of various parties in his assessment of what the pipeline event will be like when it crosses the northern Yukon:

> If the pipeline across the Northern Yukon cannot be built in one winter season, there will be great pressure to extend the work into summer and to build a gravel road rather than to postpone further construction until the following winter. Only by this means will a heavy financial penalty be avoided. But once a permanent road is in place, the likelihood is that it will be used for maintenance and repairs and will form an integral part of corridor development. (Berger 1977a,p. 26)

Berger also refers to behavioural elements on the more general features of the pipeline proposal:

> Scheduling failures will have serious financial implications for the company. . . . If the government has guaranteed cost overruns, then the government too will have an important financial stake in ensuring that the project adheres to the planned schedule. If there were a schedule failure and plans had to be changed, all of the parties concerned would react in a way dictated by their own interest. Such reaction could lead to ad hoc solutions, loss of quality control, an increase in accidents, and it might become impossible to protect the environment, the local people, and the local economy as originally planned. (Berger 1977a,p. 27)

These passages from the report indicate that,not only the technical features of the pipeline were questionable for Berger, but also how technical difficulties are translated by behaviour into actions is of central significance to him in characterizing what the pipeline event would be like.

The behavioural component of the pipeline event surfaced at various points in the hearings. In relation to the northern Yukon caribou discussion, Lent, a witness for CARC, outlined the problems associated with controlling the pipeline work force and the implications this would have on the impact of pipeline activity (MVPI,vol. 106 p. 16171). In a similar vein, the E. P. B. concentrated much of its testimony on the measures which should be taken to ensure the pipeline construction was conducted responsibly (MVPI.vol. 47-48; also E. P. B. 1974,vol. I & II).

One of the clearest critical interpretations of behavioural elements in outlining the pipeline event was in the testimony of John Sprague, a witness for Commission Counsel on water quality criteria. Here are some of

Sprague's comments on the general nature of construction activities:

> I am particularly wary of the side effects of construction activities because in my experience with mining or forestry or road construction, people doing the construction are generally very busy people and they have enough of a problem to get their everyday work done with the usual small crises that arise. My experience has been that they seldom have enough leisure time, so to speak, to be thinking about environmental problems as they work along. (MVPI,vol. 135 p. 20576)

Sprague illustrated his points by describing the particular case of the construction of an expressway across a stream in Guelph, Ontario. There had been considerable environmental planning work done for this crossing:

> We thought we had it nailed down...But what my student and I actually saw on this project bore little relation to the things we thought were going to happen. (MVPI,vol. 135 p. 20577)

Sprague described unforeseen occurences such as bulldozers driving through the stream bed,and oil spills. The moral which Sprague drew from this experience was that there needed to be detailed construction regulations, an independent inspection system and,in relation to water quality, "standards with numerical values" (MVPI,vol. 135 p. 20578). The numerical standard by implication removes some of the behavioural on-the-spot judgements from the inspection process. Judge Berger adopted a numerical standard for water quality (see Berger 1977b , pp. 90-1).

John Bayly, the counsel for COPE, included several behavioural elements as part of his assumption line of questioning . including:

that employees could be controlled, that construction could be stopped for a time to accommodate environmental concerns, and that government would create regulations and a monitoring agency. Arctic Gas, Foothills and E.P.B. participants all agreed to these assumptions as features of their assessments (MVPI,vol. 95, 99, 107). Bayly also asked Foothills witnesses whether they assumed that Foothills'pipelines would avoid areas of biological importance if it were possible(MVPI, vol. 99p. 15142). Foothills witnesses agreed to this assumption.

VI The Environmental Responsibility of Industry: The Interview Data

In the present research,participants were asked the question:

> Do you think that industry would conduct itself in an environmentally responsible manner if the questions of when,and in what way,a pipeline should be built were left up to industry to decide?

The purpose of this question was to draw from participants their general attitudes toward industry on environmental questions. In this way, participants' assessments of industry's possible behaviour in relation to environmental matters was thrown into relief. The responses of participants are summarized in Table 10 . Participants' comments were classifed as "responsible", "need regulation/cooperation", and "irresponsible", under the general heading "Environmental Responsibility of Industry". Participants who concentrated their comments on elaborating the responsible approach of industry were classified as making responsible remarks. "Need regulation/cooperation"

TABLE 10

Scientists on the Environmental Responsibility of Industry by Organization *

Scientists by Organization

The Environmental Responsibility of Industry	Arctic Gas	Foothills	E. P. B.	CARC	COPE	Comm.
Responsible	5	2	1			
Mixed	1	1				
Irresponsible		1	1	4	5	2
TOTALS	6(6)#	4(4)	2(2)	4(4)	5(5)	2(2)

*Based primarily upon responses to the question:

"Do you think that industry would conduct itself in an environmentally responsible manner if the question of when and in what way a pipeline should be built were left up to industry to decide?"

the number in brackets is the total sample size

responses were those that emphasized the need for some form of non-industry involvement in environmental areas but did not go as far as to condemn industry. "Irresponsible" replies were those which concentrated on elaborating the environmentally irresponsible nature of industry.

Five of the six Arctic Gas scientists made "responsible" comments. Two of these participants exhibited their attitude toward the environmental responsibility of Arctic Gas in their remarks on the North Slope impact issue. Here are some of the remarks of one of these participants:

> One of the big concerns was that if it wasn't built, the requisite section wasn't built in the winter, there would be pressure to build in the summer, which is a different ball game environmentally, to build a permanent road. I had never. I had never felt in all my contact with Arctic Gas' engineers that there was any plan to do that as a contingency. If it took longer to build it would take a longer number of years rather than a crash program, you know, to do summer construction. Which was a big bug bear. Everything, all my exposure indicated to me that it could in fact be built. And if there were slippages they would extend the number of winters...

This scientist also characterized Arctic Gas as the best client, in terms of environmental awareness, that he had ever had as a consultant. Another scientist with a "responsible" comment cited engineering practices in his reply:

> I would say environmentally yes. And the reason I say that is, though it sounds like motherhood and fudge, it in many respects is absolutely true. Good and sound engineering is good and sound environmental protection. What was the issue with fisheries? Erosion of the banks. Erosion and destruction of the bed of the streams. Well good engineering prevents that to start with. .... To qualify the answer I would say it might be 95% as effective as if it wasn't otherwise there just on the basis of good sound engineering.

A third Arctic Gas scientist was quite supportive of industry's environmental approach,stating that industry would be responsible whether they were regulated or not:

> Those that do have environmental training and background are now becoming the decision makers within industry with respect to how it is best to go about project planning in terms of ensuring environmental acceptability....Of course government has regulations and we must follow the regulations but I guess what I'm saying is that we'd be following them regardless of whether we were told to or not.

This environmental conscience of industry was also invoked by one of the scientists who made a "need regulation" comment. This participant stated that there was a need for government guidelines.but emphasized that public inquiries were not needed and that industry had progressed in its environmental consciousness.

In summary, no Arctic Gas scientist stated that industry, and Arctic Gas in particular, was irresponsible and would not fulfil its commitments.

Foothills participants were again split in their comments. Two scientists stated that industry would be responsible. One of these scientists paralleled the comments of one of the Arctic Gas scientists and outlined how industry would be responsible because of its growing environmental commitment:

> ...I think now that there is a growing awareness and appreciation in industry that the protection of the environment, sensitivity to the socio-economic considerations, is not necessarily diagonally opposite to the interests of the fulfilment of a development project. Yeah, I think they would... Perhaps it wouldn't be done to quite the extent that it would be done under the other process. But I'm not sure the other process doesn't lead to overreaction, and therefore overexpenditure, and so on as well...

The witness with the "mixed" comment stated that industry would be good within certain cost limitations, so that government should enforce guidelines. The scientist who remarked that industry would not be responsible stated that the "function of business" is to make money. This last participant was the same witness (discussed above) who experienced tensions with his employer. In summary, Foothills scientists exhibited a greater range of opinion than Arctic Gas scientists.

The E.P.B. was again split along the lines of conflict within the Board drawn over the acceptability of the Arctic Gas proposal. The pro Arctic Gas witness advanced that industry needs pressure put on them because of cost considerations. This witness explained the pressures of the Board, in its role as co-operative sympathetic critic:

> ... They thought many times that we were an adversary against them. In part we were but I always resented that idea. I wanted us to meet more often with the top management to build this rapport and to get them to see that we were really in there playing devil's advocate for them, not against them.

The witness who was critical of Arctic Gas stated that industry would not be responsible if left on its own, since its "legitimate goal" is to make money.

CARC, COPE and Commission associated scientists unanimously labelled industry as environmentally "irresponsible." For example, here are some comments made by one COPE scientist:

> We have so much of this kind of thing lately, so many incredible statements out of presidents of companies and others who really beat the hell out of people who even question... their role in the community. And I don't think in fact they are doing this through sheer honesty. No, I'm afraid that, perhaps even intuitively, that I'm very suspicious about large resource exploiters. I don't think they would do that in our society without regulation.... I'm not suggesting that there is any desire to blot the landscape or anything of that kind. And it is clearly better not to. But I think again they would be inclined to weigh the costs.

Some of these scientists mentioned particular cases of industrial irresponsibility, although these illustrations were not associated with the oil industry. For example, one scientist replied at great length describing several instances (armaments, drug manufacturing and testing, Ford Pinto gas tanks) where industry had been callous in its approach to the safety of the public:

> If you left a company alone to do it they wouldn't give one tinker's damn about any kind of an environmental effect. ...So if they don't really have that much concern with human lives then I think in all three instances I gave they dealt with humans, what makes you think a guy is going to worry about a bunch of whales or friggin caribou, or a bunch of bloody fish. I think you are crazy if you believe that.

VII The Environmental Responsibility of Industry: Summary

In summary, the differences among scientists in their comments on the environmental reliability of industry are consistent with their assessments of the impact of pipeline development. The "responsible" comments of the Arctic Gas, Foothills and E.P.B. scientists and the "irresponsible" comments of the E.P.B., CARC, COPE and Commission scientists clearly parallel their supportive or critical positions on pipeline development. There are, however, three cases which require some further consideration. First, there is the Foothills scientist with the "irresponsible" comment. This was the same scientist who had expressed the existence of some tension between him and his sponsor. Although his "irresponsible" comment would conflict with his public testimony, it appears to be consistent with his other interview responses. The other two cases are the industry associated scientists, one from Foothills and one from Arctic Gas, with "mixed" comments. This is a reflection of the question asked. The question was hypothetical concerning the environmental responsibility of "industry", if it were left alone. Both of these scientists stated that industry needed guidelines or regulations. They did not, however, pursue their remarks to condemn industry in principle, as did the scientists who made the "irresponsible" comments. In addition, both of them indicated in their public testimony that they did accept that, in the particular case of their sponsor, they felt that industry would behave appropriately. At no point in the interview did they contradict this public position of their sponsors. The concession by these scientists that industry needed guidelines, or else it would pursue the most profitable route, was not specified as applying to their sponsor.

VIII Technical and Behavioural Features of the Pipeline Event

There are four major points which emerge from this analysis of the technical and behavioural components of the pipeline event: first, that the use of general concepts of technical competence or environmental responsibility are highly rhetorical; second, that the subjective dimensions of conflict are reflected in this rhetorical usage; third, that the social organization of scientists is reflected in scientists' interview responses; and fourth, that the definition of the problem is crucial to the assessment of impact.

(1) On the rhetorical level, there is a broad consensus on the images of both the power of technical competence and the environmental irresponsibility of industry. Only three scientists directly challenged either concept on a general level. One Commission scientist questioned, in principle, the ability to solve technical problems. In addition, two industry associated scientists, one from Arctic Gas and one from Foothills, argued that industry would be environmentally responsible if left alone. These industry scientists do not, however, argue for the traditional environmental responsibility of industry. Both of these scientists referred only to the new development within industry, whereby persons like themselves with environmental training are now making decisions. In a real sense then, these scientists are arguing against the generally recognized consensus on the image of industry as irresponsible.

The other industry associated scientists who made "responsible" comments primarily concentrated their remarks on the confidence they had in their particular sponsor and did not attempt to argue a case for industry in general. One exception to this pattern was an Arctic Gas scientist who emphasized that good engineering, which was economically necessary, would also ensure environmental protection. This person gave the example of stream crossings where the prevention of erosion ensures both the integrity of the pipe and the downstream environment. What this scientist has done, however, is shift rhetorical ground from the behavioural to the technical. As demonstrated above, the image of technical competence enjoys a strong consensus. This provided a firmer rhetorical foundation for his argument. In contrast to the industrial scientists, scientists who were critical of pipeline development concentrated many of their remarks on the environmental responsibility of industry. I demonstrate that there is a strong consensus on these general concepts but that the application of these ideas in the comments of participants is highly selective. Industry scientists use general concepts of technical competence to reinforce their position, while scientists who are critical of development use the general image of industrial irresponsibility in their remarks to reinforce their position. Both sides have selectively interpreted cultural resources to reinforce their point of view.

(2) The second point, that the subjective dimensions of conflict are reflected in the comments of scientists, is evident in the differences between Arctic Gas scientists and intervenor scientists in how they utilize general ideas of technical competence or environmental responsibility when these concepts could be used against their position. The general consensus on the image of the environmental irresponsibility of industry clearly challenges the industry case, while the strength of concepts of technical competence supports the successful construction of the pipeline.

Arctic Gas scientists' comments on environmental responsibility and intervenor scientists' comments on technical competence differ with respect to how their replies are specified as being connected to the issue of pipeline development. Arctic Gas scientists, when they commented on environmental responsibility, all constructed statements which clearly justified their positions. In contrast, intervenor scientists simply mentioned technical ability without in general using the opportunity to challenge the technical foundation of the pipeline proposal. This reveals a difference in the defensive versus critical postures of these groups.

Arctic Gas scientists experienced conflict in the Inquiry, and were cast in a defensive position (see Chapters 4 & 5). Their defense in relation to threat led to their articulation of their case. When asked the general question on the environmental responsibility of industry, these scientists specified and elaborated in various ways how the particular Arctic Gas situation was acceptable. Although they were not asked to justify Arctic Gas' position they seized the occasion to do so. Quantitatively, this is expressed in the lack of "irresponsible" comments by Arctic Gas scientists as is illustrated in Table 10.

Intervenor scientists demonstrate a different pattern. When these scientists were presented with a general idea, technical competence, which would tend to further the industrial case, they generally recognized its importance and did not as a rule articulate how the pipeline was technically questionable. Quantitatively, this is expressed by the overwhelming ability to build consensus demonstrated in Table 9. Only two intervenor scientists took this opportunity for criticism of the specific Arctic Gas proposal. This was so despite the fact that most of these scientists did offer technical critiques of some specific features of the pipeline development proposals in public and at other points in the interview. The general issue of technical ability did not seem to be connected to their particular concerns. This reflects their dominant experience of critic where it was not necessary for them to respond to a challenge (see Chapter 4 & 5). Their critical position meant that they did not have to articulate all of the implications of their position. In the literature, this difference between critics and defenders is given further support by Nelkin, who argues that her research has revealed that critics "need not muster equal evidence" (1975, p. 53). I have described some of the subjective and rhetorical dimensions of this situation.

(3) The differences among organizations in the unanimity of scientists' views reflects the underlying patterns in the social organization of scientists within the Inquiry. The high degree of unanimity among Arctic Gas scientists on technical competence and industrial responsibility parallels the forces of

integration for scientists within that organization (see Chapter 3). In contrast.Foothills scientists are distributed almost evenly on both issues, reflecting the weak integrating social forces in their case (see Chapter 3). This greater range is also evident in relation to the E.P.B. scientists on environmental responsibility, and the intervenor scientists on technical ability (see Tables 9 & 10), and is indicative of the looseness of the social organization of experts within these organizations.

(4) The final point, that the behavioural and technical features of the pipeline event are crucial to the assessment of impact, is clear in the reasoning of most participants. The evidence for this is strongest in the case of technical competence, where supporters and critics of pipeline development used differing technical appraisals of the pipeline event in constructing arguments about its effects on biology. A difficulty with the information collected in this chapter is that the interview questions on technical and behavioural features of the pipeline event were directed at a very general level. This was done to tease out some of the rhetoric in participants' reasoning about pipeline development issues. There was not therefore, a complete interview coverage of these issues in relation to the particular

development proposals. The next chapter focuses more concretely on a specific issue related to the definition of the development problem. At the end of that analysis, some more concrete observations can be made on the role of the definition of the problem in participants' reasoning about the biological impacts. The information to this point suggests support for the contention in the literature that scientists may disagree about aspects of the issue which are external to their science.

CHAPTER 8

ASPECTS OF THE DEBATE EXTERNAL TO BIOLOGY (III): RESTRICTED AND BROAD DEFINITIONS OF THE PIPELINE EVENT

I Introduction

In this chapter I examine an additional factor in the definition of the pipeline event. In the last chapter, technical and behavioural features of the pipeline event were isolated and discussed. In this chapter I examine how a broad or restricted definition of the pipeline event is related to positive or negative assessments of its effects. I analyze the differences among scientists as to whether the pipeline alone, or a broader transportation and energy corridor, should be the object of assessment. This is a continuation of the analysis of external factors based upon the political interpretation of conflicting expertise.

II The Corridor Concept: The Public Debate

The concept of a transportation corridor came up as part of Justice Berger's terms of reference for the Inquiry. The concept was that, not just a gas pipeline, but the looping (doubling) of this pipeline, an oil pipeline, road, railroad, and communication transportation facilities would be contained in a development corridor through the Mackenzie region.

At first, the idea was put forward as a limited right of way which would be used to contain development and its impacts to a restricted area. Within the corridor plan, the route of the gas pipeline would determine the pattern of transportation and communication development. The idea of limiting development to a corridor was deemphasized in the hearings and the word corridor came to be applied primarily to the concept that the assessment of pipeline development had to be based on the general pattern of development in the north.

The corridor considerations arise out of the Expanded Guidelines for Northern Pipelines (Government of Canada 1972). On page nine of this document the idea of confining impact to a corridor is mentioned. On page ten the guidelines state that the first pipeline will establish the pattern of corridor development and that the applicant for a first pipeline is required to consider this corridor in his assessment. Judge Berger interpreted his mandate broadly and the concept of corridor as the object of assessment took on an importance in the hearings. Berger relies on page ten of the guidelines in justifying his approach (see Berger 1977a, p. 9).

One area where the corridor concept surfaced in the hearings was in the Delta phase of the Inquiry. In this phase Justice Berger expanded his terms of reference to look at the impacts of exploration work in the Delta:

> The Pipeline Guidelines foresee a whole group of activities within a corridor. If there are pipelines running along an energy corridor from the Arctic to the mid-continent, then there will be a further extension of oil and gas exploration and development into the Beaufort Sea.... this Inquiry, if it is to do its job, must assess the impact of exploration and development that would follow approval of a pipeline, and explore the penumbra of environmental and social issues that surround such activities. (Berger 1977a,p. 51)

Another area where the corridor concept was used by Judge Berger was in the assessment of impacts across the Northern Yukon. In the case of the interior route, Judge Berger cites the corridor as his primary reason for ruling against the route. Here are some of his comments from his discussion of the impacts on caribou:

> I think that a gas pipeline by itself along the Interior Route would not drastically reduce the herd, and that carefully controlled development along the Interior Route would have a less severe effect on the herd than development along the Coastal Route. Nonetheless, the cumulative effect of multiple facilities following the initial gas pipeline along an interior energy corridor, combined with the effect of the Dempster Highway, would undoubtedly be highly detrimental to the herd. (Berger 1977a,p. 42)

In the transcript of the formal hearings, the importance of considering a corridor as the object of assessment is perhaps most clearly evident in the discussion over the impacts on the porcupine caribou herd. In this testimony the CARC panelists mention their concern for further developments as part of their reasoning against pipeline development. For example, here are some of the comments of Bergerud:

> I agree with Mr. Jackimchuk's (a caribou witness for Arctic Gas) conclusions that the porcupine caribou herd can withstand a short-term influence of a buried pipeline along the coastal route. I disagree with his view of the long-term effects because further development will follow the initial route chosen, and these impacts cannot be dismissed as he has, without comment. (MVPI, vol. 110 p. 16748)

In relation to this issue, the Arctic Gas panel stated in their testimony that their assessment was only of the pipeline proposal (see MVPI, vol. 95). It appears that a major difference between Jackimchuk for Arctic Gas, and Bergerud for CARC was whether the pipeline alone or subsequent development were to be considered as the object of assessment.

Another issue in which the extent to which other developments were considered as the object of assessment is in the case of white whales and their calving activity in Shallow Bay. Arctic Gas proposed to lay a pipe across Shallow Bay in the Mackenzie Delta. This was to be done in the summer and could coincide with the calving period of the white whales who come into Shallow Bay to find warm water for their calves. Webb, a witness who appeared for Arctic Gas, stated that the cross-delta construction could be done without serious consequences to the whale population (MVPI vol. 133 p. 20153). Sergeant, a witness who appeared for COPE, expressed his concern on a range of developments in the area and recommended the establishment of a whale sanctuary which would exclude all development and hunting. Here are some of his comments on the object of his concern:

> ...my main concern is the exponential increase in activity which of course I can't foresee in detail, about the spacing of (artificial drilling) islands, numbers of vehicles involved, and so on, simultaneously over the large area of the delta. That is the root, I think, of my concern. We are adding to the hunting all these other disturbances on an increasing scale. (MVPI, vol. 122 p. 18679)

Based on his concern for the long-term compound effects of development in the region, this witness forecast the possible extinction of the herd:

> I postulate that simultaneous oil and gas activities throughout the whole delta in July, each year, could so disturb the whale herd that they would be unable to reproduce successfully. In time the herd would die out. (MVPI, vol. 122 p. 18497)

It should be noted that, during the course of his discussions, Sergeant referred repeatedly to Webb's work and, when confronted with specific statements which had been made by Webb of features of whale behaviour and reactions to disturbance, he agreed with Webb (see MVPI, vol. 122). Webb, in his testimony, concentrated only on the effects of pipeline construction. In this case, therefore, the source of disagreement appeared to be whether the individual construction project or the range of possible developments was the object of assessment.

III The Corridor Concept: The Interviews

In an effort to discover participants' views on the "corridor" issue participants were asked the question "Do you agree with Justice Berger's reliance on the corridor concept in his assessment of impact?" Participants' responses are summarized in Table 11. They were classified

TABLE 11

Scientists on the Corridor
Concept by Organization *

Scientists by Organization

Corridor as Object of Assessment

	Arctic Gas	Foothills	E. P. B.	CARC	COPE	Comm.
Pipe	5	1	1			
Corridor		3	1	4	4	1
TOTALS	5(6)#	4(4)	2(2)	4(4)	4(5)	1(2)

*Based primarily upon responses to the question:

"Do you agree with Justice Berger's reliance on the corridor concept in his assessment of impact?"

the number in brackets is the total sample size

as stating either that the object of assessment should have been the pipeline alone ("pipe"), or that it should have been a corridor, or broad range of possible developments("corridor").

The responses of participants demonstrate that there is a very strong correspondence between the support or criticism of pipeline development and opinions on the corridor issue for all participants except those associated with Foothills. Foothills participants' variation on the issue can be related to the ambiguous importance of the corridor issue to their case and the loose association of their witnesses with the organization.

Arctic Gas participants were unanimous in their rejection of the corridor concept as the object of assessment. One witness accused Judge Berger of using the corridor distinction to defeat the pipeline proposal whenever it looked as if the pipeline would be acceptable on its own:

> ...he did not assess the pipeline as a pipeline, and that whenever it looked as if well possibly the pipeline itself would not have any adverse impact then he would wave the possibility, well you might have a road, you might have a railroad, and of course you take a multiplicity of things, and the poor pipeline company was saddled with responsibility for all kinds of things which it was not proposing. ...Berger's report and his adverse view of the pipeline was based largely on the fact that he said well...while it's probably true that the pipeline alone will not have any adverse effect...we have to consider these other things, and then of course it looks as though it's going to have that adverse impact...

Other Arctic Gas scientists emphasized the necessity of having precise plans in order to make an impact assessment. For example, here are some of the comments of a witness who stated that Arctic Gas participants were so opposed to the corridor idea that they attempted to avoid answering questions on a corridor even when they were directly asked in the hearings:

> We tried hard not to answer even though we were under specific direction of the Judge to discuss, deal with, the corridor concept in our impact assessment... The corridor concept has no solid base at all from which to extrapolate. So it's an extrapolation from a floating platform because you don't know what the other facilities may be. You have no idea of how, when and where they may be built or operated, therefore, you have no base of substance from which to extrapolate. There's the fallacy, the underlying weakness really, of dealing with a corridor or trying to deal with a corridor concept.

Another witness characterized other participants who used the corridor concept in their criticisms of Arctic Gas as using value judgements:

> It's unfair for people to take, to take an issue which is a gas pipeline and the implications of that, and because of these other concerns to predicate their opinions on some moral or value judgement.

This person criticized CARC witnesses at length, stating that the main reason why they didn't want the pipeline to cross the northern Yukon was because it would violate the wildlife range, and that they had assumed incorrectly that other developments would follow.

In summary, Arctic Gas participants were unanimously opposed to the corridor concept as the object of assessment. They emphasized that the pipeline alone was the object of study which should have concerned the Inquiry.

Foothills participants were split in their acceptance of the corridor concept. The one Foothills scientist with "pipe" comments stated that the information was "soft" on a corridor since there were no specific plans for additional developments, thus making assessments extremely speculative. This scientist stated that it was "unfair to the companies" to have them responsible for further development. He commented further that, if Berger had wanted to examine a corridor, he should have set up a group like the E. P. B. to be responsible for producing information on a corridor. Both of the other Foothills witnesses stated that they agreed with Berger's concentration on a corridor. For example:

> It's easy for critics of his to say that he was taking a worse case scenario, which I don't really agree with, but I don't think he was doing that at all. Those other things would have come had a pipeline gone.

One Foothills scientist stated that he thought that it was reasonable for Berger to consider a corridor but that it was unfair for the proponents to have to present a corridor case because they had no control over future developments. In addition, this participant outlined how the major environmental issue was the intrusion of a corridor across the North Slope. In relation to this point, it should be remembered that Foothills did not plan to cross the northern Yukon and the fact that it did not go through this area was used by Foothills in its environmental argument for its project and against Arctic Gas (see MVPI vol 99).

There is, however, a tension for the Foothills participants in their endorsement of the corridor perspective. By the nature of the Inquiry they, as representatives of the proponents of the development, were to some extent responsible for providing an assessment of the corridor. This was outside their terms of reference as evaluators of the pipeline proposal. The scientist who was classified as making a "pipe" remark and one of the other scientists both pointed to how it was unfair to ask the proponent to be responsible for the assessment of a corridor. Foothills participants did not, however, have to defend corridor development to any great extent in the hearings so that this tension was not highlighted for them. The corridor was used rather, by them to attack

Arctic Gas in its North Slope construction.

The E.P.B. was split on the corridor issue, and this split paralleled their criticism or support of the Arctic Gas project. Including the one E.P.B. scientist, all scientists who were critical of pipeline development made "corridor" comments. All thirteen of the CARC-COPE and Commission scientists who made responses to the corridor question were supportive of the corridor concept. For example, here are some of the comments of one scientist:

> Obviously you can't consider it in isolation, and one of the artificial things in all development in the north has been to consider each thing in isolation.

Another scientist complimented Berger on expanding his terms of reference to include other factors. Yet another scientist paralleled these remarks and noted the importance of the corridor concept to Berger as a method of expanding his terms of reference:

> I would be totally against any inquiries... that are set up to hear single things.

Two scientists went as far, however, as to state that they did not think that a pipeline by itself would be harmful:

> ...if somebody says you know we're going to bury a pipeline or something I don't know how a guy can say that's really going to be bad for the (species) when they can't even see the damn thing.

This participant also criticized another intervenor witness in his speciality who did feel that the pipeline alone would harm the species in question. He stated that he thought this person's love of wilderness had clouded his judgment. This witness continued, however, by commenting that he was concerned about corridor development:

> I don't like to see a whole corridor of things built. (Species) are adaptable and can make it except that things get out of control. . . . Nobody can ever turn the clock back. Every time anything is developed it's got to be available to everybody.

This scientist articulated his assessment as largely based on his corridor concerns. His conflict with the other witness in his area further demonstrates the coalition nature of environmental intervenor testimony.

The importance of the corridor idea to several of the critical scientists was far less obvious. In fact,the corridor concept, as it was used by Justice Berger, was not at all clear for these scientists. For example, one scientist stated that he agreed with Berger that they "should do it all in the same area" to minimize impacts. Now this scientist was agreeing with the idea that more than one development should be considered,but has projected a use of the corridor idea to Berger which the Judge did not use. Berger did not advocate the limitation of impact through a corridor but rather used the idea of a corridor of development to broaden his terms of reference. This misunderstanding of Berger's position is evidence of this scientist's lack of involvement in the Inquiry. Three other "marginal" scientists had to have the corridor idea explained to them before they could answer the interview question. All of these participants then stated that they agreed with the principle of a broader problem focus. In addition, it was very clear that, for at least two of these scientists, a broader problem than the pipeline was important to their reasoning about impacts. The label of corridor was not, however, firmly attached to these concerns for these participants. This is further indication of their distance from the debate.

IV General Discussion of the Corridor Concept

The corridor concept, in the sense of multiple developments as the object of assessment, is very strongly related to criticism of Arctic Gas. Similarly, the pipeline alone is unanimously adopted by participants who were in favour of the Arctic Gas proposal. There were only two non Arctic Gas participants who made "pipe" comments. One was the E. P. B. witness with the strong pro Arctic Gas perspective and the other was a Foothills witness. This Foothills witness exhibited the tension between the fairly restricted terms of reference of a consultant for a proponent, and the generally critical stance of Foothills on Arctic Gas and corridor development across the North Slope. It should be noted that this participant was quite sympathetic toward Arctic Gas.

For two of the scientists who were critical of development, the corridor concept was crucial to their accounts. These scientists indicated that in relation to their area the pipeline alone would be acceptable. In contrast, Arctic Gas scientists stated that their assessments were based on the effects of the pipeline alone. The significance of the corridor issue for others is less clear.

The question of whether the corridor issue was crucial to a particular participant's assessment of impact is, however, not the only issue. What is also important is that it appears to have been collectively identified with alternate assessments of the issue. In this light it may be crucial to some participants' reasoning, more or less influential to others, and even perhaps a form of justification to yet others.

The significance of the corridor issue for scientists is not straightforward. The rhetorical aspects of scientists' statements must be considered. This is a point emphasized by Wynne:

> In science, as much as in any other aspect of social life and culture, the distinction between rationalization and practice exists and must be teased out by sociological analysis. Practice does not follow from some innate logic given in reasons. More often than we have hitherto appreciated, complex practice and commitments made in uncertainty lead to post-hoc interpretation, which often takes the form of stating "reasons" why such actions were or are being taken. (Wynne 1976 p. 338)

Both Arctic Gas and opposition scientists who state that either the restricted or the broader problem were crucial to their reasoning are justifying their position with reference to these features of the pipeline event. It is an argument which makes sensible a position, perhaps adopted for other reasons, which may not be clearly understood even by the actor himself. This possibility was raised by some Arctic Gas witnesses when they explained that Berger and some opposition scientists used the corridor argument to defeat any development because they either wished to preserve the wilderness or were emotionally critical and would use any argument to make their case.

It does seem possible that a critic of development with concerns for any violation of wilderness could advance this concern under the banner that this was not to be an isolated development. Similarly, an industry scientist who had become closely identified with a project could justify his positive appraisal by reference to a limited problem. In short, the corridor issue has become available to participants to reason about assessments of impact. The systematic distribution of positions on the issue demonstrates a crystallization of its meaning in relation to the assessment of impact. This does not indicate its actual importance for the formation of opinion. This must be done in the context of the other components of participants' opinions. There are two major elements remaining in this more complete analysis. These are the internal and translation issues discussed in Chapters 9 and 10.

CHAPTER 9

ASPECTS OF THE DEBATE INTERNAL TO BIOLOGY: THE FRAGILITY OF THE ARCTIC AND THE ADEQUACY OF KNOWLEDGE

I Internal Aspects of Science and the Explanation of Disagreement Among Experts

In this Chapter,I continue the analysis of the arguments of experts. In Chapters 6, 7, and 8,I discussed aspects of experts' arguments which were outside or "external" to the scientific content of biology. In this Chapter I examine selected aspects of the debate which are inside or "internal" to science. This internal/external distinction is often used by historians and sociologists of science in the debate about whether science develops as the result of its "internal" logic, or is subject to more broadly based "external" social influences(see Barnes 1974 chapter 5; Macleod 1977).

I am interested in investigating the relative importance of internal and external factors to the arguments by scientists as experts. I also wish to examine how the importance of internal factors for structuring debate may contribute to conflict among experts. In the analysis to this point. I have emphasized the social organization of scientists as experts at the Inquiry, and the subjective dimensions of conflict, in accounting for the variation in scientists' arguments. In this Chapter, I investigate the possibility of another overlapping social basis for the formation of arguments.

The analysis of "internal" disagreements among experts depends on some concept of science. In Chapter 1, I outlined some of the basic differences, in the literature, in the analysis of science and expertise. I argued that there are two fundamental approaches with respect to the relative importance of the external world to scientific reasoning. One emphasizes science as an objective fact-gathering activity. The other characterizes the content of science as socially constructed.

The first position is clearly displayed by Bell and Lane, who argue that science is a basically fact-gathering activity, so that the growth of objective facts circumscribes and displaces judgment. In this "end of ideology" view, uncertainty about the world causes disagreement, so that the quantitative growth of knowledge leads to consensus and problem solution. I also argued in Chapter 1 that the "objective fact" view of science underlies the view of some of the critics of this school. The "political", or "public policy" position on disagreements among experts, most clearly elaborated by Nelkin (1975, 1977) and Mazur (1973), takes the end of ideologists to task by presenting convincing evidence that scientists. as experts, have not displaced conflict, but have rather become part of, often escalating, public policy debates. But behind this criticism lies an important similarity between these camps in their view of science. As in the "end of ideology" position, the inadequacy of knowledge is the source of disagreement. As Nelkin states:

> ...technological controversies stem from factual uncertainties that allow for diverse and value-laden interpretations. (Nelkin 1977 p. 22)
>
> ... in all disputes broad areas of uncertainty are open to conflicting scientific interpretation. Decisions are often made in the context of limited knowledge about potential social or environmental impacts, and there is seldom conclusive evidence to reach definitive resolution. Thus power hinges on the ability to manipulate knowledge, to challenge the evidence presented to support particular policies, and technical expertise becomes a resource exploited by all parties to justify their political and economic views. In the process, political values and scientific facts become difficult to distinguish. (Nelkin 1979 p. 16)

The "end of ideology" school and their "public policy" critics really seem to be disagreeing over the success of science in accumulating facts and displacing judgements.

An alternative to this objective fact finding view of scientific knowledge is one which characterizes the <u>content</u> of science as socially constructed. What are considered facts, scientific methods and adequate scientific work are the result of scientists working within scientific and societal communities. What divides scientists is not a lack of facts, but what is considered a fact, and what is accepted as an adequate scientific argument. A considerable body of work has now grown up substantiating this perspective (see Bloor 1976. Barnes 1974. Mulkay 1979). As noted in Chapter 1, I have developed my analysis of the disagreements among experts from within this latter tradition in the sociology of science.

Analyzing the possibility of a scientific community base to a conflict depends on the identification of a relevant scientific community. Robbins and Johnson (1976), in their analysis of a disagreement among scientists in relation to lead exposure, suggested a disciplinary basis for disagreement in this dispute. Disciplines were not, however, a major dividing line in the case of the Mackenzie Valley Pipeline Inquiry. Zoologists, mammalogists, ichthyologists, ornithologists and botanists were distributed on all sides. There are other ways, however, of identifying communities of scientists with different cognitive styles. Scientists operate from within different interpretive traditions which may cross-cut or fragment disciplines (Whitley 1976).

The debate within arctic biology over the relative fragility of arctic ecosystems provides a case where not only are there different schools of thought which cut across disciplines, but these schools of thought are actively debating with each other. It may be possible in investigating this issue to reduce the disagreements among experts to this difference in cognitive styles.

A second issue which I investigate in this Chapter is the adequacy of knowledge for the prediction of impact. How complete or adequate knowledge is within an area of inquiry is something which is identified and decided by scientists. It is something which is the result of reasoning about the world. The issue of the adequacy of knowledge is usually treated within the sociology of science as something which varies with styles of scientific practice. For example, Robbins and Johnson argue that, in relation to lead, there are different evaluations between two disciplines of what is adequate information in support of an argument. The focus on the question of adequacy in this study is an indirect way of discovering scientific communities based on different styles of scientific practice. Conflicting assessments of adequacy may reveal systematic differences in what is considered adequate information related to different scientific models of the world.

This Chapter's analysis of internal aspects of the debate differs from the three previous chapters on external features, in that it explores the possibility of an alternate social base for the organization of expert disputes. I investigate the possibility that a difference between scientific communities may account for at least part of the disagreements among experts.
In relation to external issues I did not treat differences of opinion as possibly based in broader groups. I did not examine all those people in the world who consider a corridor of development to be the object of assessment as one

community and all those who focus on the pipeline alone as another, with the people who participated in the Inquiry as a subset of these broader communities. The External issues I discussed were for the most part directed toward the particular pipeline debate so that it does not make any sense, in the context of this analysis. to consider people as part of groups or communities organized in relation to these issues. The case of internal scientific issues is different. Scientists operate from within communities of scientific action. Numerous scientific styles are practised, and issues arising from these styles are debating points among scientists. Clear communities of scientists based on commitments to problems and traditions are often evident within science. As a result, the consideration of internal issues presents the possibility of discovering a community basis for the structuring of expert debate. It may be found in any particular case that all the scientists on one side of a public policy issue are from one community, while those on the other are from an opposing group. The debate may be organized or structured by competing scientific communities. In the analysis of the arguments by experts in the foregoing chapters, I have emphasized the social organization of experts by interest groups, and the subjective dimensions of conflict. In this Chapter, I **not** only explore a different set of debating issues but I also consider the possibility of another social basis to disputes.

II The Fragility of the Arctic

The various positions on the fragility of the arctic are not related to clearly defined specialties in the way that Robbins and Johnson's account of the disagreements in the lead insult issue are. The concept of the relative fragility of arctic species and ecosystems is a general issue within arctic biology and ecology. A study of this issue will help to establish whether there were major differences in scientific styles which could have influenced participants' reasoning about impacts.

The idea of the fragility or vulnerability of the arctic is basically that arctic ecosystems and species are more susceptible to disturbance than other species or ecosystems. Perhaps the most dramatic instance of vulnerability in relation to the arctic is the susceptibility of the tundra and the permafrost to disturbance. Vegetation in the arctic, if it is disturbed, does not recover quickly. Also, if the insulating mat of the topmost layer of vegetation and soil is stripped away and the permafrost exposed, melting occurs. Small areas of permafrost exposure result in relatively large areas of degradation of the once firm ground as the ice turns to water. This instability of the permafrost is the reason for the chilling of the pipeline. The vulnerability of the terrain is not, however, the theoretical cornerstone of the fragility argument. It is merely its most striking image.

Judge Berger argues at the beginning of his report that the arctic is more vulnerable to disturbance than other environments. Quoting extensively from Dunbar (1971), a senior member of the arctic biological community, he describes several factors which together make up the general idea of the special vulnerability or fragility of arctic species and ecosystems. First, arctic ecosystems are seen as relatively simple. That is, the number of species which are part of the system are far fewer than in temperate or tropical systems. The importance of each species to the stability of the system is, therefore, seen as greater. Damage to one species can be seen to more easily extend to the system as a whole. Second, the biological growth rates in the arctic are slower. This contributes to fragility in that there is a greater length of time required to recover from any damage which should occur. Third, arctic animal populations experience great fluctuations in numbers as part of natural cycles or as they endure periodic bad years. Thus, due to severe conditions entire generations of young are lost and the population as a whole cut back. These fluctuations can be seen as a reflection of a delicate balance, which makes these species vulnerable if a disturbance by man happens to coincide with a downswing of a population fluctuation. Berger also points to the concentration of some arctic populations such as caribou, snow geese, and white whales as making "whole populations. . . vulnerable" to disturbance (1977a p. 4).

A counter argument to the concept of fragility is that arctic environments and species are resilient or very capable of withstanding disturbances. The population fluctuations are seen from within this view to be indicative of resilience in that arctic species do bounce back. Slow growth rates can also be related to resiliency. Growth and maturity rates in fish are governed to some extent by temperatures. Thus arctic species live longer and mature later, making a broader age structure than in southern fish populations. Since there are more generations of arctic fish than southern species alive at any time, each year becomes less important to the overall survival of the population. It is, therefore, possible to lose an entire year's eggs with minimal long term effect (see McCart MVPI, vol. 90 p. 13736). In addition, arctic species are said to be resilient because the environment is harsh and anything which is able to withstand these conditions is inherently tough. One feature of this resilience in the face of harsh conditions is exhibited by the eating habits of some arctic fish species where they are not restricted to a single food source but will adapt to changing conditions of food supply (McCart MVPI, vol. 91 p. 13926).

III The Fragility of the Arctic: The Public Debate

The concept of fragility arose first in the overview hearings, which occured before the Inquiry proper, to provide a general orientation toward the subject matter. Five biologists, Bliss of the E. P. B. and Jackimchuk, Livingston, Doran and Hatfield, all industry consultants, mentioned the fragility concept. Bliss described the northern environment as "well adapted to disturbance" (MVPI, vol 11 p. 1040). The others presented accounts accentuating the variance in resilience between species (Jackimchuk MVPI, vol. 11 p. 1078), the difficulty in generalization (Livingston MVPI, vol. 11 p. 1196), and the lack of information to resolve these issues (Doran MVPI, vol. 11a p. 1196, Hatfield vol. 11a p. 1223).

The biologists who acted as critics of the Arctic Gas proposal in the Formal Hearings did not concentrate on the abstract concept of fragility. They, rather, pointed to specific vulnerabilities. For example, Lent argued for the consideration of caribou as a "wilderness species" which could not endure the presence of man (MVPI, vol. 106 p. 16177-81). Sergeant accentuated the importance of a restricted geographical area for white whale calving and, therefore, population survival (MVPI, vol. 122 p. 18494, 18519). Specific populations were discussed in terms of specific vulnerabilities. The connections to general concepts of fragility were not clear.

TABLE 12

Scientists on the Fragility of the Arctic by Organization *

Scientists by Organization

Position on Fragility Issue	Arctic Gas	Foothills	E. P. B.	CARC	COPE	Commission
Resilient	4		1	1		1
Same or not fragile	2	2	1			
Yes and no		2		2	3	
Fragile				1	2	1
TOTALS	6(6)#	4(4)	2(2)	4(4)	5(5)	2(2)

*Based primarily upon responses to the question:

"Is the northern environment fragile?"

the number in brackets is the total sample size

The clearest resiliency position came from McCart, the fish witness for Arctic Gas. He referred repeatedly to the resilience of arctic fish species in his appraisals of impact (MVPI,vol. 90 p. 13736; vol. 91 p. 13926, p. 13939, p. 13972). Here are some of McCart's general comments:

> ...all of these species have to be fairly resilient. Otherwise they wouldn't be able to survive in a climate as changeable or a regime as changeable as the one in the Arctic. (MVPI,vol. 91 p. 13940)

IV The Fragility of the Arctic: The Interviews

Participants were asked the question "Is the northern environment fragile?". Their responses are summarized in Table 12. Scientists' comments are classified as "resilient", "same or not fragile", "yes and no" and "fragile". "Resilient" refers to those responses which describe northern environments as resilient or particularly capable of withstanding disturbance. "Same or not fragile" are those comments which outline how northern environments are the same as other environments, or not particularly fragile or susceptible to disburbance. "Yes and no" responses are those which outline both fragile and stable elements of northern environments and species. "Fragile" indicates those remarks which advance the position that the arctic is biologically fragile or vulnerable to disturbance.

Four Arctic Gas scientists and one E.P.B. scientist sympathetic to their case made"resilient"comments. For example, here are the remarks of some of these scientists:

> I don't agree with the fragility concept. In fact I think it's quite meaningless as a term. I think if anything the arctic environment can best be described as resilient... My point I guess is that fragile implies delicate and in order for anything to survive under those harsh climatological conditions you've got to be anything but delicate, and that's really where the resiliency concept fits in.
>
> ...in fact, I think they're even more stable systems than many others in the world. ...My experience has taught me, I think, that the north is not that fragile, unless you're politically motivated, you see again, to say it's fragile, which immediately raises the red lights of back off, don't do anything.

An Arctic Gas scientist who undermined the legitimacy of the fragility concept stated that it was used by "environmentalists...and not by scientists so much".

Two Arctic Gas scientists minimized the differences between the arctic and other environments. For example, one of these scientists stated that each case had to be assessed individually. He went on, however, to state that there was:

> ...no evidence...or very little evidence when it comes to the living environment that there is in fact inherent fragility...

This witness pointed to stable elements and accentuated the similarity between his species of special interest in the south and the north. It is quite clear, therefore, that scientists in support of Arctic Gas made very clear statements that arctic environments and species were not in principle particularly vulnerable. Five of the scientists went as far as to state that the arctic was more stable or resilient to disturbance.

Foothills scientists avoided the extremes in their remarks. Two made "same or not fragile" comments and two made "yes and no" remarks. One of the Foothills scientists who made a "same or not fragile" remark discredited the idea of arctic fragility as possibly emotional:

> There are quite a number of southern ecosystems... that are much more threatened and endangered than northern ones. ...I don't know whether it was purposely perpetrated by someone or some group of people to get people emotionally involved, or whether it was just an accidental red herring... it's no more fragile or resilient than any other environment.

One of the scientists who made a "yes and no" comment stated that the arctic was fragile "to a point" and related how this was a contentious issue in population ecology. This person singled out the number of species and their relation to stability as a point of contention. He stated that he could not decide the general question but approached each individual case.

> I really professionally am wide open on that one. I really don't have a strong opinion and. therefore. I come down to the practical. I give an answer on practical grounds.

This scientist also outlined the particular ability of arctic species to bounce back after disturbance.

Foothills scientists were, therefore, more cautious than Arctic Gas scientists in making generalizations about arctic environments. However, none of these scientists, even in admitting fragile components to arctic environments, suggested in any way that pipeline construction was threatening to these environments.

Criticism of pipeline development is related to making "yes and no" and "fragile" remarks. It is not, however, perfectly related to these comments. Scientists who were critical of development made all of the possible remarks. Here are some of the comments by one of the two critical scientists who made resiliency remarks:

> ...I don't think it's fragile. It's a tough environment. It takes things longer to grow and animals fluctuate more and the possibility of extinction is a little easier to visualize. but I think the animals there are adaptable.

The other scientist with a resiliency comment also accentuated the ability of populations to adapt to disturbance.

The E.P.B. scientist with the "not fragile" remark made it quite clear that he was not comfortable with the fragility generalization:

> The rate of replacement in the arctic is very slow simply because the growing conditions are so poor, and if that's what you define as fragility, it's fragile. But it's no more likely to be blown away or washed away than a desert is. ... I would avoid the word...It's used a lot, and I have used it myself. It's a word you should throw away. It's been destroyed. So many words in our lexicon have been destroyed by misuse.

Intervenor scientists repeatedly expressed difficulty in accepting the fragility generalization. They were very cautious in their use of the term. This is expressed quantitatively in the five "yes and no" remarks made by CARC and COPE scientists. Here are some of the comments made by one of these five scientists which indicates the reluctance to accept the generalization:

> I don't exactly like the choice of words but I think I don't know if anybody's come up with something better... There is a slow healing process... Fragile I don't think is... It sounds contradictory. Fragile environment, and then you talk about the tough and the harsh and wild wooly arctic, and everything else. It doesn't fit right. But I think the definition of the term. It's been used so much that I don't think people understand what they are talking about. Some people do, not all.

The uneasiness with the fragility term extends even to those whom I classified as making "fragility" statements. Three of the four scientists who made fragility statements did so with a degree of rhetorical caution. For example, one of these scientists referred to the idea as the "rather clichéd notion of fragility" but then elaborated his remarks by referring to the simplicity of arctic systems and the effects of climate on them.

In this regard he related how the murres could not nest at all in Lancaster Sound in a recent year as a result of poor weather conditions:

> That's a nice example of what people tend to think of as fragility. With this climatic stress, if you then add a human stress by spilling oil all over the water, these things could summate in any one year and make it more difficult. So I suppose that is probably a valid concept.

Only one of the four fragility scientists made a clear unqualified statement that the north is fragile: Here are some of his remarks:

> That area is still extremely fragile and is not. . . amenable in any way to development.

In short, only three of the critical scientists, the two with resiliency comments and one of those with a fragility remark, accepted without qualification an extreme generalization about the arctic. The dominant comment portrayed a lack of satisfaction with the term fragile. These scientists do not express comfort with the simplification of issues which accompanies the generalization.

There is also a rhetorical dimension to the fragility idea which is revealed in scientists' comments. Critical scientists repeatedly refer to the overuse of the term. One scientist referred to the idea as "clichéd" . One scientist with a "yes and no" remark, who has not been quoted above on this issue, highlighted the rhetorical publicity aspect of the use of the term. This scientist argued for the principle of fragility in relation to terrain but did not feel it was suitable in the case of animal populations.

However, this person also stated that the concept was useful for the public presentation of a cautious environmental stance:

> I never use the word myself in my own writing. Well, I just don't like it. It's catchy and it served a purpose as a public media word. You know, it's hard to develop any ecological arguments for the use of the word. ...Actually, I am in favour of everything that word conveys. I agree with the warning sign which is conveyed by the use of that word and, therefore, I don't object to people using it. I can't bring myself to use if because I prefer to talk about specific things.

This scientist agrees with the rhetorical use of the word. This was the way in which some Arctic Gas associated scientists accused intervenors of employing the image of a fragile arctic.

V Summary of the Fragility Interview Responses

Firm positions on the fragility issue, that is positions other than "yes and no" are not related to criticism of the pipeline proposal. If the critical E.P.B. scientist is included, critical scientists who made firm remarks are shown to be almost evenly split on the issue with three making "not fragile" or "resilient" comments and four making "fragile" remarks. The acceptance of a "resiliency" or "not fragile" argument is not linked for these three scientists to an acceptance of pipeline development.

In contrast, all of the scientific supporters of the Arctic Gas proposal adopted a "not fragile" or "resilient" position. In fact, five out of seven of these scientists took the more extreme resiliency position. There was no indecisiveness in the Arctic Gas camp.

This contrast among scientists of different organizational affiliations is, I have suggested, a reflection of the social organization of experts and the subjective dimensions of conflict outlined above (see Chapters 3, 4 and 5). The Arctic Gas proponents had developed their case over a great period of time and were the focus of a tremendous amount of criticism. The theoretical reinforcement of their position in their adoption of the resiliency, or not fragile, idea can be seen as a result of this defensive position and the time for its articulation.

The case of Foothills provides further evidence for the importance of the defensive position of Arctic Gas defenders. Foothills scientists were evenly split between indecision and "not fragile" comments. None of these scientists adopted the extreme resiliency position. Foothills scientists did not undergo the long term involvement and criticism experienced by Arctic Gas scientists, and, therefore, did not need to articulate a theoretical justification.

The critics were not forced to defend their position on a variety of fronts through time. They did not have to adopt a firm defence but merely had to argue against various, even fragmented, features of the development proposal. They did not, therefore, have to articulate a unified theoretical justification of the issue at hand.

The differences among biologists in the Berger Inquiry cannot be reduced to a split on the fragility issue. The variation in unanimity between sides can be systematically related to the more local social experiences of scientists and not to competing schools of scientific thought. This does not mean that the fragility issue may not have been important for the reasoning of particular scientists. In some cases, scientists held strong fragility/resiliency positions which may have influenced their assessments. In addition,this does not violate the image of science as socially constructed. It rather indicates that there is a great deal of interpretive looseness within arctic biology on this issue. The fragility metaphor does not dominate debate.

Another dimension which emerges from the above considerations is the high degree of indecisiveness on the fragility issue by intervenor scientists. The "yes and no" position was adopted by five of the eleven CARC, COPE and Commission scientists. Although this contains some element of the fragility position, it is more striking for its indecisiveness. These scientists recognized the fragility argument but did not feel comfortable in adopting a clear position on the issue. This may be a form of uncertainty argument. Scientists are reserving judgement,perhaps for more convincing information. This uncertainty theme is pursued in the next section.

VI The Adequacy of Knowledge: The Public Debate

The question of the adequacy of knowledge entered the Inquiry debate at important junctures. The industrial proponents were obliged to make an environmental assessment as part of their application to government to proceed with the project. Industry had to do enough research to support the claims it made in its application.

The consultants who testified on behalf of Arctic Gas expressed a high degree of confidence in the amount of knowledge which they produced. For example, here are remarks made by Banfield, the co-ordinator of the consultant biologists for Arctic Gas:

> .... Government agencies and the foundations such as the Arctic Institute of North America had not previously had the funds to undertake studies at the level that has been undertaken with respect to this project. The project has made a major contribution to our knowledge of fish and wildlife in this large area of North America. I believe that we now have sufficient information to form the basis of an adequate environmental impact assessment and of mitigative procedures to protect the environment. (MVPI, vol. 89 pp. 13517-8)

Judge Berger disagreed with this positive assessment of the state of knowledge about the north:

> The gaps in environmental knowledge that I have listed here for the Delta-Beaufort region are complemented by a similar need for environmental information in the other areas that are of concern to this Inquiry: the Mackenzie Valley and the Northern Yukon. Together they underline the fact that present scientific knowledge is inadequate to serve the needs of government in assessing the impact of proposed oil and gas developments in the North. (Berger 1977a, p. 58)

The biologists who testified on behalf of intervenors at times highlighted the lack of knowledge. The clearest inadequacy argument came from Calef on caribou. Calef made an overview, in his testimony, of the inconsistent findings by biologists on caribou and the various interpretations of the same information:

> Such uncertainty indicates that even survey data are open to interpretation.... I submit, therefore, Mr. Commissioner, that this is not the level of accuracy for the continuity of surveys which we require to even detect changes in caribou populations, let alone to attribute them to specific causes. Within the Canadian Wildlife Service, for example, we find one group of biologists who believe that the caribou have declined; another group who think they haven't, both using the same data. (MVPI vol. 106 p. 16192)

The public information clearly demonstrates a difference among some participants on the adequacy of scientific knowledge for the prediction of impact. I will now consider the more systematic interview information.

VII <u>The Adequacy of Knowledge: The Interviews</u>

Participants were asked the question: "How would you assess the adequacy of the knowledge base for the prediction of impact?". Responses were coded as "adequate", "mixed" and "inadequate". These are summarized in Table 13.

In the interviews, defenders of development tended to state that knowledge was adequate, while critics tended to emphasize a lack of knowledge. This tendency was, however, weaker in the latter case. Critics' opinions on adequacy were more varied than defenders. This is consistent with the findings on other components of participants' views, therefore reinforcing the importance of the social organization of experts and the subjective dimensions of conflict outlined in Chapters 3 through 5.

Nine scientists stated that there was adequate knowledge. Six of these scientists were associated with industry. Industry scientists who stated that knowledge was adequate sometimes qualified what purpose for which knowledge was adequate. For example, one industry scientist stated that it was adequate for that stage of the application process. What is adequate is seen to relate here to what can reasonably be expected to be known before the construction of a project. Another industry scientist stated that the knowledge was adequate for the state of the art of assessment at that time. But some industry scientists felt that the knowledge base was adequate without reference to any criteria of adequacy:

TABLE 13

Scientists on the Adequacy of Knowledge by Organization*

Scientists by Organization

Position on Adequacy of Knowledge	Arctic Gas	Foothills	E P B.	CARC	COPE	Commission
Adequate	4	2		2		1
Mixed		2	1	1	1	
Inadequate	1		1	1	4	1
TOTALS	5(6)#	4(4)	2(2)	4(4)	5(5)	2(2)

*Based primarily upon responses to the question:

"How would you assess the adequacy of the knowledge base for the prediction of impact?"

the number is brackets is the total sample size

> I think we had a pretty good data base on which to go. Even those who were adverse to the project recognized that the data base was fairly complete.
>
> Three critical scientists also made "adequacy" statements.

One of these scientists specified the purposes for which knowledge was adequate; that is, to make a decision about sensitive areas:

> Under the circumstances I am 100 per cent confident. Anybody who is doing research obviously has never enough time, never enough data. But for the type of work that we were into, it was good enough. .... we knew where the most sensitive areas were.

One of these critical scientists made a very general statement on the adequacy of knowledge within biology on his species and not in relation to some practical problem. In these comments, he was critical of other scientists who, like him, opposed development but made "inadequacy" arguments:

> ...I've spent my whole life on this species, and I think we know quite a bit about the animal. You know, the next guy down the road says we don't know anything about the animal. But things that come out in these are things that I think are predictable, so I think that we have a pretty good data base. ....(other critical scientist) is there as an authority on (species), and he's never studied (species). And he's saying that we don't have a lot of things that we are supposed to have.

This criticism is evidence of tensions among some critical scientists on scientific issues. This was a tension which was not evident in relation to industry.

Four of the five Arctic Gas scientists made "adequate" remarks. Although there was one Arctic Gas scientist who made an "inadequate" remark, this lack of knowledge was not seen as large or significant. This scientist stated that there was not information on the distribution of a species in an area where there had been a route change at a late point in the hearings. He claimed this deficiency could be remedied with observation over a short time period. This was a localized deficiency and not a fundamental criticism of the adequacy of knowledge. Arctic Gas scientists were not, therefore, fundamentally split on their assessments of adequacy. They were far more unified than any other group.

Foothills participants were evenly divided between "adequate" and "mixed" remarks. The "mixed" remark made by most scientists was that there was good knowledge in some areas but little in others. This was the comment made by one of the two Foothills scientists with "mixed" comments. The other made more fundamental comments about the character of knowledge about the environment. On the one hand, this person stated that the amount of knowledge was "reasonable", but he qualified this by stating that there were some questions which could not be answered. This he related to the nature of environmental knowledge:

> It's environmental assessment. And the environmental area in general is rather soft science.

Foothills scientists were, therefore, more divided than Arctic Gas scientists.

The most common comment of critical scientists was that there was inadequate information. Seven out of twelve critical scientists made this remark. The perception of a fundamental lack of knowledge is clearly caught in the remarks of one of these scientists:

> .... we are learning every year more about this ecosystem.... we are learning more about what can go wrong, but we are still so damn far away from really having a hold on it that we feel constantly inadequate in answering specific questions.... Here we are dealing with a sought after degree of information which will, in fact, never be achieved. or not in the lifetimes of the people now working.

In summary, the social organization of scientists and their experiences within the Inquiry are reflected in the differences in the patterns of participants' remarks. Arctic Gas scientists were more unified than were intervenor scientists. This reflects their long term association and defensive stance which they had to adopt throughout their association with their client (see Chapters 3, 4, and 5). The relationships here are not quite as strong as in other cases, with one Arctic Gas scientist and one E. P. B. scientist who supported the Arctic Gas case, admitting to some lack of information. If the industry defenders as a whole are considered, including Foothills, three of these scientists made a "mixed" and one an "inadequate" remark, so that four out of ten supporters of development referred to at least some inadequacy. It is clear that in these cases the existence of uncertainty is interpreted as not having negative consequences for development. In a similar vein, three critical scientists made "adequate" comments. It is possible for critical scientists to argue against development with what they perceive as adequate knowledge. The significance of a decision about the adequacy of science is not as fixed and needs interpretation.

VIII <u>Internal Features of the Debate in Biology</u>

There are three major interrelated points which emerge from the analysis above. First, the patterns of scientists' interview remarks reflect the social organization of scientists as experts, and the subjective dimensions of conflict outlined in Chapters 3, 4 and 5. Second, the debate among biologists cannot be reduced to one of conflicting scientific communities. Third, the significance of scientific judgments is subject to varying interpretation in making an argument about impacts.

The point that scientists' interview remarks reflect the social organization of scientists and the subjective dimensions of conflict (see Chapters 3, 4 and 5) is clearly seen in a comparison of Arctic Gas scientists with intervenors. Arctic Gas scientists were unanimous in rejecting a fragility position on the arctic, and with only one exception, stated that there was adequate knowledge. In contrast, critics displayed a greater heterogeneity of comments, with three out of twelve scientists rejecting fragility and three out of twelve stating that knowledge was adequate. The comparative homogeneity of Arctic Gas scientists reflects their long term associations and the need to articulate a defence on a broad front of issues. This suggests a rhetorical dimension to participants' statements. Statements vary with the demands of making an argument from a particular social location. These findings are similar to those on external debating issues outlined in Chapters 6, 7 and 8.

The second major point is that the debate among biologists in the Inquiry cannot be reduced to conflicting scientific communities. This Chapter considers the part which science plays in generating conflict among scientists as experts. There are two major approaches within the literature on disagreements among scientists as experts on this issue. One emphasizes the interpretive action of scientists in creating and maintaining scientific facts and problematics. The image which is often relied upon here is the existence of different schools of thought within science with competing ways of generating scientific statements. The other major approach concentrates on the amount of knowledge within science as opposed to its style of generation. In this view, a lack of knowledge allows political or social policy positions to impinge upon reasoning by scientists.

I have developed my analysis from within the Sociology of Science tradition which portrays science as socially grounded interpretive action. In accordance with this view, I have attempted to discover whether scientists were organized around internal issues on internal lines, perhaps in the form of communities. The findings above indicate that the Inquiry debate in biology <u>cannot be reduced to a conflict between communities of scientists</u>. This was shown by the lack of disciplinary split among sides with members of various disciplines supporting competing sides. This was also shown for schools of thought in the case of the debate over the fragility of arctic ecosystems and species. And further, scientists' comments on fragility and adequacy were found to vary in a pattern consistent with their experiences with their sponsoring organization, each other, and the Commission. This suggests the importance of these other factors for structuring action (see point 1 above).

But to say that conflicts among scientists cannot be reduced to, or accounted for wholly, by a conflict among communities of scientists is not to minimize scientific interpretation. There were many cases within the Inquiry where scientists argued about fundamental scientific questions.

There was not, however, a single overriding internal scientific issue which divided all scientists and structured the debate.

The third point, that the significance of scientific judgments is subject to varying interpretation by actors, becomes clear where scientists have made statements which go against the usual pattern for a critic or defender of development. For example, a fragility position is associated with criticism of pipeline development. However, three critics rejected the fragility image altogether, with two of these participants making resiliency remarks. But these scientists did not draw the implication from their positions that development was satisfactory. The case of the adequacy of knowledge follows a similar pattern, with both defenders and critics adopting positions on adequacy which could be reasoned to be inconvenient. Not only do scientists have varying scientific interpretations but they also vary in how they interpret the significance of these judgments.

The issue of the "translation" of the significance of scientific judgements is crucial for an understanding of reasoning by participants in expert settings. In the next Chapter, I explore the issue of how uncertainty is interpreted by scientists to be significant for practical action. This issue in translation is used to examine more generally the logic of scientists' reasoning about impact.

CHAPTER 10

TRANSLATING SCIENCE AND THE EXPLANATION OF DISAGREEMENTS AMONG EXPERTS

I Introduction

This Chapter has two main purposes. First, it continues the analysis of scientists' opinions. I have examined external and internal features of scientists' views in Chapters 6 through 9. In this Chapter, I conclude this analysis with the consideration of the "translation" of the significance of scientific judgements into prescriptions for action The term "translation" plays on the internal/external distinction. If science is an activity within a specialized community of practitioners who share a pattern of discourse, then the products of science must be translated into the terms of other forms of discourse in order to be "understood". The question of recognized uncertainty is the focus of this analysis.

Second, I consider the question of the relative importance of the various components of scientists' views in determining their pattern of reasoning. This arises out of the examination of the ways in which scientists resolve uncertainty. I broaden this analysis to a general consideration of the structure of opinion in the Inquiry and the explanation of disagreements among experts.

The difference between communities of discourse has been analyzed in relation to science in a number of ways. Kuhn (1970) has argued for the incommensurability of competing schools of thought within the same discipline when one arises and succeeds another. Robbins and Johnson (1976) have characterized the disagreements over low level lead insult as resulting from competing styles of scientific practice within different disciplines (see Chapter 1).

Schutz has also provided an analysis of science which revolves around a distinction between styles of reasoning which has implications for the analysis of translation and expertise. There is a disjunction, for Schutz, between reasoning within the world of science and reasoning within the everyday world. The terms and concerns of one world can never be completely translated into the pattern of discourse of the other (Schutz 1971 p. 230; see also Ravetz 1971 pp. 315-402).
However, although there may never be an "accurate" translation between realities, Schutz argued that people do translate and interpret between realities (1971, p 14, p 351).

In this Chapter, I have followed this idea from Schutz's analysis. Although it may be that one science "really" may not be translatable into another science, or into everyday discourse, translations are done as a practical accomplishment. Scientific practitioners translate the significance of the work of previous generations. Scientists from within competing "disciplines" translate the importance of the work of their opposition. And scientists, as experts, translate their scientific judgments into practical concerns. In short, translations or interpretations of scientific knowledge are routinely carried out.

There are three major ways in which translation issues arise in the relationship of scientific knowledge to everyday lay knowledge. The first two involve problems of translating the language of one into the language of the other. First, in the direction of translating science into lay language, this involves explaining what a science means in layman's terms. Second, in the other direction, there are the difficulties associated with the translation of lay problems into scientific terms. This is the area where such practical lay concerns as identifying what is "dangerous", "damaging", or "natural" are translated into a scientifically determined type or quantity of exposure or disturbance. The third major area of translation is the interpretation of the significance of scientific findings for practical actions. As opposed to arriving at an equivalence of terms, this translation involves the interpretation of the implications of scientific findings for practical actions. This last area is the translation which I am dealing with in this Chapter. In this analysis, I concentrate on the interpretation of uncertainty for practical action.

In Chapter 9, the question of the adequacy of knowledge was shown to be an important issue in the Berger Inquiry biology debates. Some scientists made arguments that there was uncertainty, while others did not. This is not peculiar., I submit, to this particular case. For example, Nelkin, in her analysis of the Cayuga Lake nuclear power plant siting controversy, as part of her argument for the presence of uncertainty quotes from scientists who state that there is not enough known (1971 p. 93). I have questioned the concept of uncertainty as something which causes disagreement. Instead, I think of uncertainty as a product of science and is itself, therefore, a possible area for disagreement (see Chapter 9). However, as a possible outcome of scientific reasoning, uncertainty may function in the way that Nelkin and Mazur have indicated. If there is "uncertainty" then this must in some way be "resolved" before practical implications can be derived from knowledge. This crucial role of uncertainty arguments is analyzed below.

II Uncertainty Arguments: The Public Debate

Uncertainty arguments occurred frequently in the Inquiry biology debates. Judge Berger stated that:

> ...we must on this, our last frontier, proceed only with the most complete knowledge of, and concern for, the flora and fauna of the North, for the biomes of the forest and the tundra. (1977a,p. 5)

This complete knowledge was clearly not available in the view of Berger (see 1977a, pp. 57-8). Development could not, therefore, proceed.

There were numerous claims for uncertainty on the part of witnesses put forward by the intervenors (see Chapter 9). Calef, who testified on caribou for CARC, incorporated the existence of a great deal of uncertainty into his argument against pipeline development. Calef argued that the same information could be routinely interpreted in a different fashion by different scientists. He showed how this was true in the past and how he could do it in the present with the same data that the witnesses for Arctic Gas used to defend the pipeline application. Calef prefaced his argument with the statement "that because of our lack of ability to predict effects, we must err on the side of caution" (MVPI vol. 106 p. 16189). He concluded his testimony by raising the spectre of the possible destruction of the herd,and arguing for caution because of the herd's importance and the uncertainty of determining effects.

> ...I made the statement that the Porcupine caribou herd could decline by as much as 90% in five to ten years. Such was the fate of the 40-mile herd, and such was the fate of the Nelchina herd in Alaska. Whether the declines of these herds can be attributed to the developments and activities of man is not entirely clear to me. But that 90% decline of great caribou herds did occur is unequivocal. I do not think that we are in a position to say that the proposed CAGSL pipeline will not produce or contribute to similar declines in the Porcupine herd, and when we're dealing with 115,000 animals, with one of the last wildlife spectacles on the face of the earth, with a very important part of the culture, the history and the current well-being of the native peoples who have inhabited the continent for at least 25,000 years, with the representatives of a group of animals whose lives have been part of the world of human beings for tens of thousands of years, both here and in Eurasia, I feel that we have an awesome responsibility to proceed slowly and cautiously with projects which may ultimately destroy them. (MVPI vol. 106 p. 16240)

Sergeant, who testified for COPE on whales, also translated the importance of uncertainty in terms of cautious action; but he was far more explicit in his recommendations. Sergeant recommended the establishment of a whale sanctuary in the western portions of the Mackenzie River Delta where the white whales calve. Sergeant developed his argument at length concerning the lack of information on the effects of oil spills and increased human activity on the calving behaviour of white whales in the delta.

> With such incomplete knowledge, what action can be recommended? I believe that it would be prudent to take action which would prevent the calving animals in the delta from being subject to the possibility of disturbance, throughout the whole delta simultaneously. That is, I believe that a sanctuary or reserve should be set up in the western part of the delta where the main mass of whales occurs in July.... This reserve should be totally free from all disturbance, including hunting. (MVPI vol. 122 p. 18494)

Both Sergeant and Calef are making similar uncertainty arguments. They both state that there is not enough known, that potential damage is great and, therefore, the best course is to avoid disruption. A similar argument was made by Jackimchuk, an Arctic Gas witness on caribou, in his support for pipeline development.

Jackimchuk was cross-examined at length concerning the state of knowledge within caribou biology in general, and in relation to the Porcupine caribou herd in particular. Jackimchuk conceded that it was not possible to establish a cause-effect relationship between the introduction of a disturbance and effects on the herd because of the multiplicity of factors involved and the difficulties of measurement. The solution, therefore, is to avoid interaction.

> It would be difficult to tell, that is why we prefer to avoid any potentially damaging interactions. In other words, taking the - I guess what is referred to as looking at it from a downside risk point of view, and try to achieve protection by avoidance. (MVPI vol. 94 p. 14275)

Jackimchuk has minimized the importance of uncertainty by referring to the avoidance of contact with caribou, which is built into the construction routing and schedule. Under such circumstances the uncertainties become unimportant.

> It would be desirable to have definitive answers to the points ....just in the same fashion as it would be desirable to know the cause of the common cold, but it is not necessary for the treatment of the problem. (MVPI,vol. 95 p. 14480)

Other industry scientists dealt with the presence of uncertainty in different ways. McCart, the Arctic Gas witness on fish, was also questioned on the various things which he did not know about fish populations. He replied that it was not necessary to know all of the particulars since there is a general body of literature on fish which can be relied on in making predictions of effects (MVPI,vol 92 p. 14010). Another way of minimizing uncertainty for Arctic Gas scientists was to state that uncertainty would be dealt with through further study of specific problems and the design of solutions in the light of this further study (see Banfield MVPI, vol. 89 p. 13525-6, McCart MVPI, vol. 92 p. 14051, Gunn MVPI,vol. 93 p. 14160).

When uncertainty was recognized by Arctic Gas scientists, it was never articulated to challenge the existence of adequate knowledge and the reasonableness of pipeline development. Through a variety of arguments, recognized uncertainty was shown to be consistent with proceeding with the project. Uncertainty was translated as having no negative effects on the action of pipeline construction. This contrasts with the uncertainty translations made by critical scientists. For these scientists,uncertainty was argued to require caution and the curtailment of development.

It seems that the possible types of uncertainty arguments which can be made are numerous and complex. References to other completed research, future research, theoretically postulated vulnerability or resiliency, the ability to solve problems, and the integrity of opponents are all various moves carried out by participants in their arguments. These argument patterns deserve detailed separate study and are beyond the limits of this analysis. In this study I am focussing on the recommendations for action which participants make when they are confronted with uncertainty. It is in relation to this general translation issue that I classify andcode participants' interview comments in the next section.

III Uncertainty Arguments: The Interviews

The interview data reveal a similar pattern to that in the public debate, with conflicting ways of translating uncertainty into action. Scientists were asked the question:

> Where uncertainty exists in the knowledge base, how do you think an impact assessment should be resolved? Would you tend toward caution and decide against proceeding with a project, or would you tend toward confidence and decide in favour of the execution of a project?

Scientists were coded as making "uncertainty is manageable", or "uncertainty is not manageable" remarks. "Uncertainty is manageable" remarks are those which reduced the importance of uncertainty for making decisions about impact. "Uncertainty is not manageable" comments accentuate the importance of uncertainty in making decisions about impact, and highlight caution as a way of translating uncertainty. Scientists' comments are summarized in Table 14.

All of the scientists who defended pipeline development were classified as making "uncertainty manageable" remarks. Some of these scientists included references to caution in their comments. For example, one scientist stated that when there is uncertainty one should "proceed with caution" and build safety features into the development plans. Other scientists were very critical of the accentuation of uncertainty by critical scientists:

TABLE 14

Scientists on the Consequences of Uncertainty for Action by Organization *

Interview Responses

	Arctic Gas	Foothills	E.P.B.	CARC	COPE	Comm.
uncertainty manageable	6	4	1			
uncertainty not manageable			1	2	5	2
TOTALS	6(6)#	4(4)	2(2)	4(4)+	5(5)	2(2)

*Based primarily upon responses to the question:

"Where uncertainty exists in the knowledge base how do you think an impact assessment should be resolved? Would you tend toward caution and decide against proceeding with a project or would you tend toward confidence and decide in favour of the execution of a project?"

\# the number in brackets is the total sample size

\+ two CARC scientists did not show a clear style of translation so they were not coded.

> .... there's that endless cry for more research, more research. Our position was, and certainly in my mind the correct and responsible one is, that six years of research had gone into a broad range of topics at considerable length, and it's for sure we don't know how ecosystems respond, we don't know how they respond in southern Alberta, therefore, the argument that we shouldn't do anything is, I think, irresponsible.

One of these scientists attacked critical scientists who accentuated uncertainty as motivated by self-interest or public policy attitudes.

> This is one of the great difficulties of biologists, especially in universities. They want grant monies. They want to keep going for the next ten, fifteen years. So they'll always tell you they don't have enough information.... And if our motivation then is either we want more grant monies to train more students in the future, we're never going to admit we know all we need to. And if our other motivation is that we're not really in favour of northern development anyway, then we'll use this as a tool.

Some of these scientists referred to the concentration on uncertainty by critics as unscientific since science, they reasoned, always has elements of uncertainty associated with it, yet decisions are made. To be stumped by uncertainty was, therefore, unscientific.

There was, however, a difference among defending scientists in their criticism of opponents. Including the E. P. B. scientist who supported Arctic Gas, five of the seven scientists who defended Arctic Gas made disparaging remarks about opponents on the uncertainty question.

In contrast, only one of the four Foothills defenders did this. They rather concentrated on explaining and justifying their own position. This is yet another reflection of the relative lack of conflict over time associated with the Foothills position.

Ten of the twelve critical scientists who made remarks were classified as making "uncertainty unmanageable" comments. Two of these scientists referred to their caution as part of their being scientists. For example, one scientist referred to scientists as conservative and, therefore, cautious. In contrast, the supporters of development were described by this person as adopting an "engineering approach" with an emphasis on problem solving ability. This concept of engineering optimism appeared in the remarks of two other critical scientists. Optimism is, by implication, unscientific. On the whole, however, critical scientists' remarks were not aimed at pulling down industry. Here is a typical response:

> I would see myself falling in the cautious category.... But in a situation where I felt that that we really know too little to predict impact or to understand impact, where there could in fact be foreseeable events which would be serious ones on the environment, then I would stand on the side of caution and recommend that we wait...

Critical scientists overwhelmingly voted for caution. The two exceptions were classified as "other." Neither of these scientists addressed uncertainty translation in abstraction. One of these scientists stated simply that there was enough known in this particular case and declined any general remarks. The other identified this translation issue as outside of science, and as such not something for scientists alone to decide.

> I think the expert witness is entitled to give a conclusion, to come down on one side or the other having spelled out the uncertainty. ....I think he's then into the main question that the tribunal has been established to answer, and I think at that stage he starts to exceed his. I think the witness is entitled, and should be cross-examined to make sure he gives that opinion, but then it can easily be ignored by the tribunal.

I would like to suggest that the importance of the slightly greater variability in critics' comments with the two "other" remarks, and the generally less polemical nature of critical scientists' remarks on the uncertainty issue, rests with the subjective dimensions of the debate outlined in Chapters 3, 4 and 5. Critical scientists were less involved in the debates and with their sponsors, and were, therefore, relatively heterogenous in their views. Their lack of involvement and their critical as opposed to a defensive stance has resulted in them being less polemical in their remarks. These findings are consistent with those of Chapters 6 through 8 where a similar difference was noted.

IV Uncertainty and the Role of Public Policy Concepts in Scientists' Reasoning

Nelkin emphasizes the importance of uncertainty in opening up scientific reasoning to the influences of political and public policy attitudes (see Chapter 1 and 9). In the present research,I have treated uncertainty as a judgement that is negotiated or recognized by people. I would like to develop the argument further by noting that uncertainty, once it has been recognized, is translated for its significance. It must in some sense be resolved in terms of its practical meaning,and other concepts may assist in this resolution. In this way, if public policy attitudes are used to resolve uncertainty, then uncertainty may operate as Nelkin has suggested.

I found some evidence in the Berger Inquiry that public policy attitudes were used to resolve uncertainty. In order to outline the way in which public policy ideas appear, here are the remarks, at some length, of one Arctic Gas associated scientist:

The opposition to any development is going to emphasize the gaps in the information, and the proponents of the development are going to emphasize the large volume of information they have, and it seems to me, that with respect to Arctic Gas they have outdone themselves. Now they may have made mistakes, there's no doubt about that, not so much in the environmental area, but in the engineering with the problem of frost heave. And they made errors in their experiments and things like that. But if you're looking for total certainty you'll never get it. It's not possible in this world, and it's not possible in science. .... Well, kind of in general, I would err on the side of caution, but at the same time you've got to recognize that there is a point beyond which you can't go. I mean it's all very well to say well companies have to come up with an absolutely airtight case.... a universal statement that there will be no adverse impacts. Logical impossibility. Certainly impossible for science because science doesn't make those kinds of statements. Science deals in probabilities and it deals in terms of theories. You're trying to generalize from a body of known facts. Well, your generalization can be wrong. Nobody can guarantee that kind of thing. God might be able to, but no man. And how much are we going to? Companies aren't inexhaustable mines of money. The companies that can afford to build these things by themselves, and without government support are the kinds of companies that simply go and spend their money elsewhere. We have to have development, otherwise, in the Northwest Territories, as I say, I don't think that the indigenous peoples can survive at that population growth rate. They can't survive on a renewable resource economy. .... I would suspect that most of them are living on the dole, and that most of the money that goes into the Northwest Territories is money that's generated in the south and shipped into there. It's simply going to become more of a problem. Now, I don't know. You going to turn it into a zoo up there with a bunch of people running around catching whatever they can and living a substandard existence. or what are we going to do about it?

This scientist has not directly stated that uncertainty should be ignored because there is a need for development. Rather this person is saying that there were areas of uncertainty for Arctic Gas, but that there is a limit to the resources which can be brought to bear by a company in the effort to dispel uncertainty. He argues further that excessive demands on these resources will discourage development, and that development is desirable. The reasoning on public policy attitudes comes after a general statement on the universality of uncertainty in science and human affairs. Nevertheless, this scientist has used a public policy argument in favour of pipeline development as part of his response to the uncertainty issue.

There were only two other scientists who included public policy components in their remarks on translating uncertainty. One industry associated scientist emphasized the political dimensions of the pipeline issue and stated that the local interests of the peoples in the area may have to give way to the national interest. This person developed this idea in a multi-levelled way. This, he stated, was at the political level. He continued his remarks by analyzing the importance of uncertainty on the environmental level, where he stated that development should proceed cautiously. In his reasoning, these components appeared to be distinct. The other scientist, a critic who included public policy attitudes, was clearer in specifying how public policy attitudes would affect his reasoning:

> I would tend toward the cautious side, unless it could be shown to my satisfaction that the thing was really necessary.

This person went on to state that in,the case of the Mackenzie Valley pipeline,

> ....it's a project which isn't benefitting the area or the country. It is benefitting people who are using the product wastefully anyway.

Is this person saying that public policy questions have not influenced his judgement since he normally would be cautious? This "normal" caution would then be affected by public need for development, if this need is severe. But. as part of an argument against the project, this person goes on to state that the need is not there. Does this mean that this person's public policy assessment of a lack of need for pipeline development has affected his reasoning about impact, or has he referred to this lack of need as additional justification for being opposed? The priority of public policy attitudes in this reasoning and in the other two scientists quoted above is not clear.

There are other ways in which uncertainty is translated by scientists, aside from the introduction of public policy attitudes. For example, one Arctic Gas scientist argued that uncertainty was not a problem because the technological capabilities of industry would design solutions. Another Arctic Gas scientist introduced a resiliency argument over the adaptability of arctic species. And two critical scientists questioned the ability of engineers to solve problems, citing past failures as evidence. In these cases, ideas on the ability to build and the fragility/resiliency issue are introduced by scientists in their reasoning about uncertainty. In summary, although public policy remarks are not dominant in scientists' reasoning on uncertainty, scientists do introduce a variety of other factors outside of a direct analysis of uncertainty in their interpretation of the meaning of uncertainty.

In Nelkin's treatment of uncertainty, uncertainty is a state of affairs about which people reason, and in their reasoning introduce public policy attitudes. In contrast, I have treated uncertainty as something which is the product of reasoning. It is something which is negotiated and argued about. The introduction of public policy ideas into an argument about the significance of uncertainty does not mean that uncertainty has caused public policy concepts to be dominant. It simply means that in making an argument involving recognized uncertainty, it is sometimes necessary to draw upon other types of ideas. This way of analyzing uncertainty raises a rhetorical or persuasive dimension to scientists' statements.

V Uncertainty as Rhetoric and its Implications for the Analysis of Expert Debates

A rhetorical dimension to uncertainty discussions in science is demonstrated in a study by Pinch of the question of uncertainty in solar neutrino physics. Solar neutrino physics is the study of the production of neutrinos (mass-less particles) by the sun. This scientific area is interdisciplinary, with four main participating disciplines. There is an outstanding problem within this area in that predictions of neutrino production do not tally with the results of experiments. Pinch investigated how

scientists dealt with the question of uncertainty and certainty in their assessment of the various disciplines and the source of this experimental problem. In interviews, scientists very strongly tended to accentuate the uncertainties in the work of scientists in other disciplines while their own work was argued to be more firmly grounded (1981 pp. 145-6).
Whether scientists did this sincerely or cynically is difficult to assess. Pinch found that a few of the scientists made comments to the interviewer which contradicted this justificatory usage, including, at times, the statements they had given at earlier points in the interview.
For example, one scientist took the interviewer aside after the tape recorder had been switched off and stated that he was not confident in his field. This was even though he had made an earlier certainty argument (1981 p. 153). The impression which is conveyed, is that the admission of uncertainty in relation to one's own field was not acceptable in this case. This interpretation is reinforced by the comments of another scientist who, after being reassured that he would not be identified in any way, made an uncertainty remark in relation to his own field (1981 p. 153).

The justificatory pattern of the uncertainty remarks made by these solar neutrino scientists is clear. Pinch suggests that scientists have taken him, the researcher, as a representative of the public and have formed their accounts to defend their area.

> The lack of agreement over scientific certainty recorded in this paper is consistent with the view that the origins of assessments of certainty lie in the social world. Scientists, it seems, can "rationally" express either certainty or uncertainty in their own and other areas. If such assessments are social in nature then it is not surprising that one constraint is the potential audience for comments on certainty. In particular, I have argued that, in view of the public shape which the solar neutrino debate has taken, when scientists perceive a possible public audience they tend to act defensively and stress the certainty of their own areas - while, at the same time, doubting the certainty of others.' (Pinch 1981, p. 155)

The implications which Pinch draws for public policy debates such as nuclear power from this pattern of uncertainty discussion within science are instructive for the present study.

> .... it may well be that scientists committed to the nuclear power programme will express greater confidence in public than they would admit in private, or perhaps to close colleagues. This suggests that the way to analyze such debates is not in terms of whether the contentious scientific knowledge is really certain or uncertain, but in terms of the different audiences for such claims. This is not to accuse scientists of cynical bias but to point out that nuclear power science is as much a social product as solar neutrino science. (Pinch 1981, p. 155)

The arguments of scientists are, according to Pinch, in the direction of making a claim for the certainty of their knowledge. This concentration on certainty claims is also evident in Mulkay's discussion of expertise. After outlining the subtle and complex nature of scientific reasoning, Mulkay argues:

> In such a situation, one possible option is that of admitting openly that no clear scientific conclusion is possible. But scientists have not normally acted in this way. One reason for this may be that scientists enter the political context as purveyors of certified knowledge. They have nothing to offer other than the supposed certainties of science; and if they were to present their conclusions as no more than "plausible guesses" based on uncertain foundations, they would carry little political weight.
> (1979,p. 117)

Mulkay is arguing that there would be a pressure towards making certainty statements,because of scientists' role as the carriers of certified knowledge. To make an uncertainty claim may imply that there is no certified knowledge. In affect, if scientists made uncertainty claims they would invalidate their role as expert and thus lose their political weight.

My research has shown that this is not the case. I have demonstrated that,with biology in the Mackenzie Valley Pipeline Inquiry, some scientists made uncertainty claims for their own and other scientists' knowledge. Critical scientists accentuated the importance of uncertainty in arguing against pipeline development. They did not do this just for industry scientists. They also did it for themselves. These scientists claim that they are experts with special knowledge, including the knowledge that there is uncertainty. This uncertainty stance did not reduce the political weight of these scientists' input. In fact, they won the day, and they were quoted as experts by Justice Berger when he referenced his uncertainty argument (Berger 1977a pp. 57-8).

This is not unique to this case. For example, Nelkin quotes scientists who made uncertainty claims in the Cayuga Lake nuclear power plant siting controversy (Nelkin 1971 pp. 93-7). In Cayuga Lake the critics also triumphed.

Both Mulkay and Pinch accentuate the defensiveness of scientists as experts. That is, scientists are argued to need to justify and defend their positions. I would argue that the argumentative structure of public policy debates involving scientists does not require a defensive stance from critics. This has been observed by Nelkin.

> ... those opposing a decision need not muster equal evidence. It is sufficient to raise questions that will undermine the expertise of a developer whose power and legitimacy rests on his monopoly of knowledge or claims of special competence. (emphasis original, Nelkin 1975, pp. 53-4)

Pinch has transfered the defensive justificatory arguments which can occur within a scientific research area, fragmented by disciplines, to the situation of scientists as experts. In this case, groups of scientists both criticize their opponents and justify their own position. In fact, justification is perhaps most important. Within science, arguments must be supported or justified.

The case of scientists as experts in public policy discussions is somewhat different. The proponent of a new development must make an argument that will be acceptable. Critics need only show that this argument is unsatisfactory. This can be done simply by pulling down the proponent's case. It need not include an alternate certainty argument. The crucial difference between "scientific" debates and "expert" debates is that, within expert discussions, justification is not necessarily equally required for all experts.

I think there will, however, be a great deal of variation in the actual incidence of justificatory certainty claims in expert debates. It would seem likely that the structure of justification may shift according to circumstances. In the case of actions which are already being carried out, such as the widespread use of pesticides, it may be up to opponents of the practice to build a case and not simply to criticize. And further, some expert debates may overlap with scientific debates so that scientific certainty claims may be common on both sides. Finally, the extent to which uncertainty is accepted as a description of a science may vary among disciplines.

The strength of Pinch's examination of solar neutrino science is that he demonstrates that certainty arguments vary with the social requirements of scientists. The examination of the question of uncertainty takes on a different character here for Pinch. As opposed to examining whether there really is certainty, the project becomes the examination of how certainty is talked about. I have developed a similar strategy in my analysis of the opinions of biologists. The important object of analysis is the pattern of discourse about pipeline impacts and not the actual importance of various components to participants' reasoning as it really occurs inside scientists' heads. The analysis of what scientists say is not the same thing as the analysis of what they actually think.[1] Scientists' statements are part of arguments which they make about pipeline impact, and these arguments may be made for a variety of reasons.

I think it is more sociologically useful to analyze the observable utterances of scientists as opposed to their invisible purposes and priorities. Mills, in his study of motivation, has elaborated how motives may be studied in this way:

> ... we must approach linguistic behaviour, not by referring it to private states in individuals, but by observing its social function of coordinating diverse actions. .... As over against the inferential conception of motives as subjective "springs" of action, motives may be considered as typical vocabularies having ascertainable functions in delimited societal situations. (Mills1940, p. 439)

The reasoning that goes on inside people is essentially private, whereas the statements of people which are displayed are shared and available to other members of a group. These collective symbols are observable and can be related to the social context within which they occur. That is, in different social locations there are varying ways in which the actions of people are accounted for (see also Lyman and Scott 1970,pp. 111-144, Goffman 1959,p. 252).

My concern is with the explanation of the disputes among experts in a public inquiry. More precisely, I am interested in the explanation of the differences in the opinions, which scientists as experts express, on the impact of pipeline development. The opinion statements of scientists must be analyzed in relation to the structure of the socially available arguments about impact, and the social forces which operate upon scientists in their adoption of this argumentative structure. In this type of analysis, the actual importance of particular elements to the "real" reasoning of particular scientists is of little consequence.

VI The Sociology of Experts in the Berger Inquiry and the Structure of Impact Arguments

In this section I consider the overall pattern of scientists' arguments about impact. This general pattern is investigated through the examination of "extreme" remarks. These patterns are related to the social organization of experts and the subjective dimensions of conflict. This summary analysis provides the foundation for the explanation of disagreements among experts.

Extreme comments are the clear opposite positions taken in reply to interview questions. For example, the extreme comments on scientists' attitudes towards development would be classified as "for" or "against" as displayed in Table 8 in Chapter 6. "Mixed" remarks would not be an extreme comment. All of the extreme comments were isolated on the seven topics which I have identified in this study as related to reasoning about pipeline impacts. The next step I took was to identify which extreme remarks reinforced the argumentative position of each organization. I have called these "extreme legitimizing remarks". In the case of Arctic Gas and the three critical organizations - CARC, COPE and the Commission - these comments were opposite. Arctic Gas legitimizing comments were those which were labelled as for development, can build, industry responsible, pipeline alone is the object of assessment, the arctic is resilient, there is adequate knowledge, and uncertainty is manageable. In contrast, the extreme legitimizing remarks for critics were: against development, cannot build pipeline, industry irresponsible, corridor is the object of assessment, arctic is fragile, there is inadequate knowledge, and uncertainty unmanageable. The E.P.B. was assessed as having the same organizational interest as Arctic Gas. The Board was funded by Arctic Gas and its report formally supported the pipeline proposal, provided certain recommendations were followed. Finally, Foothills' extreme legitimizing remarks were the same as Arctic Gas, with the exception of the corridor issue. Foothills used the prospect of corridor development across the North Slope as part of its argument against the Arctic Gas route. This was a problem which Foothills did not share with Arctic Gas as its route was restricted to the river valleys which were already transportation corridors.

I have also identified a second type of comment, "ideally contradictory remarks", for each organization,which are the extreme comments opposite to the extreme legitimizing comments. For example, for Arctic Gas,a comment which accentuated the fragility of the arctic as opposed to its resiliency would be considered as contradictory.

It should be clarified that in both cases I have not identified what is really legitimizing or contradictory for <u>individuals</u> as they actually argue their assessment. For example, it was shown above that some critical scientists used "adequacy" statements as part of their arguments against the pipeline. In this case they are using a "contradictory" remark as part of a legitimizing argument.

The extreme "legitimacy" and "contradictory" remarks are an "ideal type" of polarized argument. A perfectly polarized argument would be one in which every particular issue was polarized for all participants. Weber has developed this concept of ideal type in relation to rationality:

> ... it is convenient to treat all irrational, affectually determined elements of behaviour as factors of deviation from a conceptually pure type of rational action. (Weber 1947 p. 92)

Similarly, I have identified what an ideally polarized debate would look like. I then analyze the actual pattern of argument in relation to this ideal and explain its variance. The distinction between individuals and groups is important in this construction. The ideal argument is constructed in terms of the interests of the organizations. The extent to which the individual scientists adopt this ideal in their argument is in part a measure of the extent to which they are in accord with organizational interests.

Legitimizing remarks are summarized in Table 15. In this Table the percentage of legitimizing and contradictory remarks is given in a variety of ways. I give percentages for external elements, for internal and translation components, and for all of these together. These are broken down by affiliations according to separate organizations, industry scientists vs. critical organization scientists[2], and all scientists. There are two numbers in each box. The number to the left is the percentage of extreme legitimizing statements. The number in brackets is the number of remarks upon which the percentage is based.

Ideal contradictory remarks are summarized in Table 16. This Table has an identical structure to Table 15. The number to the left in each box indicates the percentage of ideal contradictory remarks and the number in brackets indicates the number of comments upon which the percentage is based.

TABLE 15

Scientists' Extreme Legitimizing Interview Comments
by Affiliation of Scientists

Scientists by Affiliation

Extreme Legitimating Interview Comments by Issue Area	Industry Organizations			Critical Organizations		
	Arctic Gas	Foothills	E.P.B.	CARC	COPE	Comm.
External Extreme Legitimating Comments	95% (21)*	60 (15)	43 (7)	79 (14)	72 (18)	60 (5)
	74 (43)			73 (37)		
	74 (80)					
Internal/ Translation Extreme Legitimating Comments	82 (17)	50 (12)	33 (6)	33 (12)	73 (15)	67 (6)
	63 (35)			58 (33)		
	60 (68)					
All Extreme Legitimating Comments	89 (38)	56 (27)	38 (13)	58 (26)	73 (33)	64 (11)
	69 (78)			66 (70)		
	68 (148)					

*() number of comments upon which percentage is based.

TABLE 16

Scientists' Ideal Contradictory Interview Comments by Affiliation of Scientists

Scientists by Affiliation

Ideal Contradictory Interview Comments by Issue Area	Industry Organizations			Critical Organizations		
	Arctic Gas	Foothills	E P B	CARC	COPE	Comm
External Ideal Contradictory Comments	0% (21)*	27 (15)	57 (7)	14 (14)	11 (18)	0 (5)
	19 (43)			11 (37)		
	13 (80)					
Internal/ Translation Ideal Contradictory Comments	6 (17)	0 (12)	17 (6)	25 (12)	0 (15)	33 (6)
	6 (35)			15 (33)		
	10 (68)					
All Ideal Contradictory Comments	3 (38)	15 (27)	38 (13)	19 (26)	6 (33)	18 (11)
	13 (78)			13 (70)		
	13. (148)					

*() number of comments upon which percentage is based

There are two major findings revealed by these tables. First, there is a great deal of difference among organizations in the extent to which scientists approach the ideal. Second, there is a difference between external and internal/translation issues in the extent to which debate is structured in relation to these issues.

The first point on the differences among organizations is clearly seen in the overall percentages. From Table 15, eighty-nine per cent of all Arctic Gas scientists' remarks were legitimizing. This was sixteen per cent greater than the nearest organization, COPE, whose seventy-three per cent of scientists' comments were legitimizing. Together scientists associated with critical organizations made extreme legitimizing remarks only sixty-six per cent of the time or twenty-three per cent less often than Arctic Gas scientists. But this was greater than the other two industry groups. Foothills scientists made only fifty-six per cent legitimizing comments, while the E.P.B. had the lowest with thirty-eight per cent.

This pattern of responses can best be understood with reference to the analysis of the social organization of experts and the subjective dimensions of conflict outlined in Chapters 3, 4 and 5. Arctic Gas scientists worked for a long period of time, in a situation where they had to defend their case. These scientists have, therefore, articulated the ideal defence of their organization's interests. In contrast, the scientists associated with critical organizations have not adopted to the same extent an extreme legitimizing (or critical) stance. These scientists did not, by and large, have the long associations with their sponsors that Arctic Gas scientists experienced. They also did not have to agree with each other as critics. They simply had to, one way or another, be critical of the industrial application. Criticism does not require unanimity.

The two remaining groups of scientists associated with industrial organizations experienced a greater diversity of views because of the weak sources of social cohesion and their argumentative situation. Foothills had to mount a defence in an extremely short time span, thus lacking the time for a defence to be clearly articulated among its scientists. In addition, Foothills was not placed on the defensive during the hearings but was largely ignored. Foothills scientists did not have to articulate a defence on any scale approaching that of Arctic Gas. The E.P.B. suffered from a confusing mandate and weak ties among members through a long period of time. This resulted in a split within the organization with one scientist articulating an industry case and another scientist articulating a critical stance. Not only are thirty-eight per cent of the remarks made by these scientists legitimizing, but, as it is shown in Table 16, fully thirty-eight per cent are contradictory. This is nineteen per cent more than any other organization and in this case these contradictory remarks were used as part of arguments against pipeline development. In summary, the social organization of scientists and the subjective dimensions of conflict are reflected in the overall pattern of scientists' remarks.

The second major point concerns the structure of assessment arguments. Table 15 shows a clear difference between the percentage of legitimizing arguments made by scientists on external versus internal/translation issues with seventy-four per cent making legitimizing external statements and sixty per cent making internal/translation legitimizing statements. This suggests that the debate was structured on external issues more than on scientific issues. This does not mean that scientific issues are not important, or even less important to individuals' reasoning. It is simply that a few scientifically related issues do not structure the debate for as many participants as do a few external issues. Collectively the debate is not organized around scientific issues as much as around public policy issues.

This impression is reinforced through closer examination of the response patterns. The two groups of scientists with the least amount of exposure to the debates, those who testified for COPE and the Commission, demonstrate a slight reversal of the observed trend. In their cases, they either have a lower percentage of external legitimating comments (CARC), or they have no difference between legitimating external and internal/translation remarks(COPE). However neither of these groups accomplish this reversal of the general trend by a lower percentage of external legitimizing comments. COPE participants, at seventy-two per cent, are only seven per cent below CARC, at seventy-nine per cent, and Commission scientists, at sixty per cent, are only twelve per cent below COPE. In addition, outside of the Arctic Gas scientists, COPE and CARC scientists have the highest percentage of legitimizing internal/translation comments. Commission scientists, at sixty-seven per cent, are fully thirty-four per cent above CARC scientists, at thirty-three per cent, and twenty-seven per cent above Foothills, at fifty per cent. COPE scientists are even further ahead with seventy-three per cent. One possible reason for this difference is that CARC and COPE scientists were perhaps, more than other scientists, selected for their specific scientific ideas. These scientists were, by and large, involved with the Inquiry for only a matter of days, and were selected by their sponsors to make specific scientific points. As a consequence, their scientific responses more closely correspond to ideal type scientific legitimizing remarks than do other scientists, except for those associated with Arctic Gas. The shortness of their association is also, paradoxically, associated with the existence of contradictory remarks in the case of Commission scientists. Commission scientists had the highest percentage of contradictory remarks, thirty-three per cent, of any organization.

It appears that although the Commission may have selected these scientists to make particular scientific points, these scientists are still not integrated with their sponsor to the extent of wholly adopting the logical consistency of an ideal argument.

The more highly involved participants' responses further accentuate the importance of external over internal/translation issues for collectively structuring the debate. As shown in Table 15, CARC scientists, at thirty-three per cent, were tied with E. P. B. scientists in having the lowest number of legitimizing internal/translation remarks. This was forty-six per cent lower than their external comments. CARC scientists, at twenty-five per cent, also had almost as many contradictory internal/translation comments. Clearly, the ideal internal/translation argument was not as salient for these scientists.

The case of conflict within both the E. P. B. and Foothills is instructive for reinforcing the importance of this trend. In the case of the E. P. B., the conflict between scientists is not expressed in internal/translation terms to anywhere near the extent it was on external issues. As shown in Table 16, fully fifty-seven per cent of external remarks are contradictory, thus indicating the great conflicts within this organization. However, only seventeen per cent of internal/translation remarks were contradictory. Conflict is structured here more clearly on external issues. Similarly, in the case of Foothills one of the scientists indicated that there was tension between him and his sponsor. This is partly reflected in the twenty-seven per cent contradictory remarks for Foothills on external issues. However, there are no ideal contradictory remarks on internal/translation issues. In this case, conflict is expressed, or structured, in external terms.

In summary, the debates among scientists in this instance are more strongly structured in terms of external ideas than they are for internal/translation ideas. This was shown through a variety of factors, including the higher proportion of external legitimizing comments, and the concentration of conflict within organizations on external features. In addition, these patterns in participants' responses were shown to vary with the social circumstances of scientists.

The establishment of the importance of external remarks in the structure of debate is not part of an argument for the dominance of external ideas in the explanation of disagreements among experts. It is a demonstration that collectively the debate in biology had more generality and coherence on external issues. This social level of analysis is crucial and relates back to the basic question in the sociological explanation of disputes among experts. The actual importance of the various dimensions of the pipeline issue for the reasoning of experts is fundamentally a problem with an individual focus. The evidence, therefore, of the relative uniformity of external factors in participants' remarks does not address the question of the relative importance of external factors to thinking. The analysis of the structure of arguments in the present study becomes,rather,a consideration of the social production of expert debate. The debate itself is the object of analysis and not the internal workings of people's minds. This point is clarified and elaborated upon in the next, and final, Chapter.

FOOTNOTES

1 I should emphasize that this is a position which I now hold having developed the research in this thesis. I began this research by equating what was said with what was thought. For example, in a preliminary analysis of the disagreements among biologists in the Berger Inquiry, I treated scientists' replies to some of the questions analyzed above as direct indicators of their real feelings and attitudes.

2 In this distinction, critical organizations are not the same thing as critical scientists. For example, the E P.B. is organizationally within the industry camp yet one of its scientists was clearly critical of development.

CHAPTER 11

CONCLUSION: TOWARD AN INTERPRETIVE SOCIOLOGY OF EXPERTISE

I Introduction

In this Chapter, I summarize the findings of the thesis and elaborate on its theoretical and practical implications. There are three major sections to this Chapter. In the first, I deal with the methodological and theoretical importance of the findings. In the second, I suggest areas for further study. In the third, I suggest some of the practical implications of this research.

II Theoretical and Methodological Implications

There are six major theoretical and methodological issues which this dissertation addresses. First, I criticize the polarized parallel structure image of expert debates which is prominent in the literature. Second, I argue for the importance of systematic interviews. Third, I argue the importance of a sociological analysis of experts to an understanding of the structure of debate. Fourth, I show the importance of treating participants' statements as interpretive verbal behaviour as opposed to more or less accurate information. Fifth, I shift the problem of the relative importance of external versus internal "ideal" factors to scientists' thinking to the problem of the analysis of the structure of debate and the extent to which identifiable "material" factors influence this structure. Sixth, I propose that the analysis I have done in the dissertation indicates that an interpretive political sociology of expertise is a fruitful line of inquiry.

1. Polarization and Parallel Structure:

The literature on experts outlines an image of expert conflict as polarized. In this literature scientists are portrayed as equally and oppositely critical, with constantly escalating claims and counterclaims (see especially Mazur 1973).

I have argued that this was not the case in relation to the particular example of the Mackenzie Valley Pipeline Inquiry. Experts in this debate were not equally and oppositely extreme in their arguments. I have attempted to demonstrate this difference through a systematic detailed analysis of seven debating issues (see Chapters 6 - 10). I have tried to show that Arctic Gas experts were very unified in their adoption of extreme legitimizing arguments - that is, extreme comments which reinforce the position of their sponsor. I have also demonstrated that experts associated with intervening organizations, who were critical of development, lacked agreement with each other, and did not articulate extreme legitimizing arguments to the same degree as Arctic Gas experts. These findings on the issue of parallel structure are elaborated in terms of a "sociology" of experts which I discuss in the next section.

2. The "Sociology" of Experts:

The strength of a case study is the general social relations which it uncovers. The finding that there is not a parallel structure is not helpful if its significance is confined to an isolated anomalous case. I have tried to show that this lack of parallel structure is related to specifiable features of the social situation. The presence or absence of a parallel structure in debate can then be related to social conditions which can be identified beyond an individual example. I would suggest that the structure of debate is greatly influenced by the resources of interest groups, the social organization of experts, their interaction experiences, and their basic critical or defensive argumentative stance.

The opposing groups in the Mackenzie Valley Pipeline Inquiry varied greatly in their structure, resources, interaction experiences, and argumentative stance. Arctic Gas was a large company with extensive resources of time and money to develop their case. Arctic Gas had to develop a defense of its application. That is, it had to justify, as opposed to criticize, and it was tested in this defensive position throughout a protracted inquiry in which Arctic Gas representatives were cross-examined and questioned.

These features of the Arctic Gas situation provided strong pressures for the unanimity of Arctic Gas experts. Arctic Gas experts were, because of extensive resources, able to be carefully selected to argue the company position. These scientists worked for at least five years developing and articulating their organization's case. As agents of the company in a public inquiry, Arctic Gas experts received much criticism. These pressures are documented in Chapters 3, 4 and 5 on the social organization of experts and the subjective dimensions of conflict. This social situation of Arctic Gas experts is reflected in the cohesive arguments made by these experts in favour of the Arctic Gas case (see Chapters 6 through 10).

The example of Arctic Gas is striking but all of the other organizations, and the experts associated with them, can also be understood in terms of these same forces. The critics of development, CARC and COPE, had relatively meagre resources of money and time. These organizations did not have to defend a clear position as much as they had to criticize the industry proposals. They did not, as critics, need to agree with each other. They simply had to disagree with Arctic Gas.

These differences in the structure of the critical organizations' situation made for a great difference in the social setting of critical experts. The lack of resources of these organizations meant that they could not develop their own expertise and group cohesion. Some of the experts who appeared for intervenors had such short associations with their sponsor that they were unable to identify the group for whom they had testified. Even among those CARC participants who were involved with their organization for some length of time, there was considerable infighting (see Chapter 3). These organizations appear more as a loose alliance than as a cohesive group.

The lack of need for unanimity in a critical stance is evident in the case of CARC scientists where on internal/translation issues they shared, with E.P.B. scientists, the lowest percentage of extreme legitimizing remarks (see Chapter 9 & 10). More generally, all of the critical organizations' experts made only 66% extreme legitimizing remarks as compared to 89% for Arctic Gas scientists (see Chapter 10).

The lower justificatory needs of critics are also evident in the structure of their arguments. The analysis of the uncertainty issue in Chapter 9 and 10 demonstrates a lower requirement to justify a critical position. Critical scientists argued that they did not know. Many critical scientists did not justify themselves by stating that they had enough knowledge to make a decision; rather, they undermined the solidity of prediction itself. This points to a possible difference between expert debates and debates among scientists within scientific communities. In expert debates there can be a lack of similarity in the argumentative requirements of critics versus defenders. Critics need only criticize.

This finding is corroborated by Nelkin in her discussion of two other case studies (Nelkin 1975 p. 53).

Other examples of the "sociology" of experts in the present case study reinforce those given above. The lack of clear organizational goals and the loose structure of the E. P. B. was reflected in great internal conflicts. Further, the lack of long term association of Foothills witnesses with Foothills is evident in a greater degree of social and conceptual distance between these scientists and their sponsor than is evident with Arctic Gas scientists.

The pattern is, I submit, clear. The social situation of experts, including the character of their organizational involvements, the interaction experiences resulting from their situation, and the argumentative demands of their critical or defensive part in debates, has consequences for the pattern of arguments by experts. An adequate analysis of disputes among experts should take into account these features.

Beyond this general directive on the importance of a sociology of experts, the specific importance of interest groups in structuring expert debates is a major finding of this dissertation. I would suggest that controversial issues involving experts would almost certainly, by being controversial, have interest groups which structure debate. The interest group basis of debate appears as a crucial focus for the sociological analysis of disputes among experts.

3. The Importance of Systematic Interviews:

The research style in the literature on disputes among experts has been very eclectic and loose. Researchers have engaged in their studies often without specifying their methodology. Writers have tended to use multiple data including public information, private documents, and interviews (which are unspecified as to their number, sample and structure). These various components are then woven together in a "commonsense" fashion, in that it is not often specified how it is done, presenting illustrative evidence to support a reading of events. It is possible that this methodology has contributed to the polarized image of debates which is dominant in the literature. There is a tendency in the literature to analyze the visible competing experts in a debate, thus creating an image of polarization.

I have argued for the importance of systematic interviews to the analysis of disputes among experts. Interviews with a large sample of all of those who appear as experts in a public policy debate demonstrate a greater range of involvement than the polarized image which is present in much of the literature. The use of interviews in the present study has contributed to a more complex view of the nature of debates.

Interviews have also allowed the more thorough consideration of the opinions of experts. Debating points which develop in public discussions are not necessarily a thorough survey of scientists' opinions. This was demonstrated in the interviews where, for example, scientists were shown to be able to generate public policy opinions related to pipeline development, something which was very rare in their public pronouncements.

In addition, systematic interviews have helped in the construction of a sociology of experts. The analysis of the social organization of experts is centrally based on the interview statements of scientists about their sponsors (see Chapter 3). The subjective dimensions of conflict were investigated through a consideration of the interview statements by participants on other participants. Interviews made this type of analysis possible.

4. Participants' Statements as the Object of Analysis:

I have treated the statements of scientists as the object of analysis and not as more or less accurate accounts. In constructing a sociology of experts, I have not assessed whether participants' statements about their sponsor or each other are "accurate". Similarly, when I consider scientists' assessments of uncertainty, I do not treat these as more or less "correct" reports about whether there is uncertainty. Rather, I have treated participants' statements as action which is the product of a social context and as such an indicator of the nature of that context. Participants' remarks vary considerably. As opposed to deciding who is correct, I have chosen to construct a sociology of this variability. The strength of this approach lies in the patterns which are uncovered when what participants say is related to their social situation.

I have tried to show that experts vary systematically among organizations with respect to their comments on their sponsors, other participants, and debating issues (see section 2 above). The statements experts make about their sponsors vary with the pattern of social organization of experts, and as such this helps to clarify the nature of this social organization. For example, I have not analyzed Arctic Gas participants' uniformly positive comments on their sponsor as more or less accurate depictions, but I have rather taken these remarks as an indication of the relationship between these experts with their sponsor (see Chapter 3). Similarly, the comments by participants on other participants are related to the involvement of participants in the debate, and as such help to illuminate this involvement. For example, Foothills experts were shown to be fairly positively disposed toward other participants,while other participants were demonstrated to have very critical comments on Foothills,making it the most criticized organization. I took this as evidence for the lack of direct confrontation between Foothills participants and others,thus reducing Foothills experts' need to defend their position (see Chapter 4). In none of these cases have I attempted to assess participants' statements in terms of their accuracy.

The differences among experts in their debating stances have also been related to social factors. I have treated expert arguments as observable products of social situations. That is, I have not developed judgments about the "real" underlying personal reasons for an individual's arguments and, consequently, the actual importance of a particular issue to an individual's thinking.[1] For example, conflicting comments on the corridor issue were shown to be strongly related to support and opposition to the Arctic Gas proposal. The actual importance of this issue to thinking by experts is not, however, clear.
I can show that it would logically follow that a certain position on the corridor issue would have certain assessment consequences.
Stating that the corridor is the object of assessment considerably broadens the possible impacts from that of a pipeline alone, and this could make development impacts more severe. Indeed, the "logic" of this argument seems to have been accepted by Arctic Gas experts since they clearly stated that their problem was the pipe alone and that their assessment could be different if the corridor were the problem (see Chapter 7).

There may be a difference, however, between what people say is important to their thinking and what really has been important to their thinking. I have studied the arguments which people make. However, the reasons for individuals making arguments can be quite numerous.

If the underlying relationship of an individual to the argument he makes is the object of analysis, then an explanation of this relationship must be made. But the boundaries of this explanation are unclear. Does the analyst investigate the childhood of an individual, or his school days, or his ethnic background? These would all be methodological hurdles for an analysis of thinking as it occurs within individuals. Sociologists interested in this type of problem would have to attend to these issues.

Since I have chosen to study the debate itself, the actual importance of various issues to the thinking of individuals becomes less important. Debating issues are negotiated and argued within a social context. They are a form of verbal behaviour available to other people. This observable aspect of debates makes them collective events, analytically separable from the orientations of individuals toward the debates. In this way, I have argued that the degree of unanimity of experts' arguments within an organization is related to the social contingencies specified in section 2 above.

The importance of this approach can be considered in relation to the selection of experts by organizations. All of the organizations involved wished to make arguments on particular debating issues. They all sought experts to make these arguments. In some cases, experts were rejected since, for whatever reason, they were seen by an organization as not able to make the argument desired. In all of this it is the symbolic performance, an argument about the impact of pipeline development, which is the focus of organized action. How a scientist, within himself, has managed to make an effective argument is not the central issue. The social pressures are toward a symbolic performance and not in relation to the thinking processes of individuals. These social pressures in the projection of an argument lend credibility to analyzing arguments as the result of social pressures.

5. Internal and External Factors in Debate:

The literature on expert disagreements gives some causal importance to ideas in the explanation of disagreements among experts. In this section, I discuss the direction of causal analysis in light of the points which I have so far established. I argue that interpretive action allows for the local social context to structure arguments. The nature of reasoning creates the possibility for the causal importance of "material" forces. This contrasts with the emphasis on the importance of "ideas" which is prominent in the literature.

Nelkin has stated that the existence of uncertainty is the reason why scientists disagree:

> . . . technological controversies stem from factual uncertainties that allow for diverse and value-laden interpretations, and that technical questions become controversial largely because of the difficulty of determining the often fuzzy boundaries between fact and value. In short, the more controversial an issue, the greater the merger of fact and value. (Nelkin 1977, p. 22)

Controversy is related to value conflict based upon uncertainty. To use the internal/external distinction, the weakness of "internal" knowledge has meant that, in order for people to decide on an issue, they must rely on their "external" values, resulting in escalating controversy. When controversies have developed, however, Nelkin has also argued that: ". . . the value premises of the disputants colours their findings" (Nelkin 1979, p. 16). For Nelkin, although controversy develops because of the lack of factual scientific knowledge, once it has developed values affect science in an escalating interplay (see Chapter 1). In all of this discussion Nelkin has explained the existence of controversy with reference to the structure of ideas.

A different trend in Nelkin's writing is evident when she refers to experts being used by interest groups to further their cause (Nelkin 1975, p. 51). An implication of this observation is that controversy develops through a clash of group interests. I have developed this interest group basis of conflict in this dissertation. The various interest groups in debate have presented experts and I have attempted to explain the nature of debate by referring to this organizational base as well as other features of the social situation of experts (see section 2 above). This is an explanation of disputes which relies not on some relationship between ideas but on some social basis.

A distinction needs to be made between an account of how it is possible for experts to disagree, in terms of the nature of reasoning and arguments, and the explanation of the structure of a particular dispute among experts. The model of reasoning I have adopted allows the consideration of social factors as structuring influences.

I have relied on a different model from Nelkin of how scientists reason and disagree. I have relied on an image of science as interpretive action. Judgment enters into the creation of facts and not just to compensate for the lack of facts. What is or is not a fact, certainty or an adequate argument is negotiated by scientific practitioners. It is possible for scientists to reason routinely in conflicting directions (see Chapter 1). But this outline of how scientists can disagree does not provide an explanation of the form of a particular disagreement among experts. It does not tell us why particular groups of scientists have argued in a specific way. This explanation of the structure of particular debates is possible through a consideration of social factors.

I have developed my analysis using a model of science as not only interpretive,but also as socially conditioned. Arguments by scientists are formed in specific social contexts (see Chapter 1). Building on this model of science I have tried to show the importance of the social situation of expertise for structuring expert disputes (see section 2 above).

> . . . the way in which scientists interpret and draw on their expertise outside the research community will vary with the social setting in which they are operating and with their position in that setting . (Mulkay 1979, p. 113)

When applied to the issue of the relative importance of internal versus external factors to disputes among experts,this sociological argument shifts the focus of analysis. I have not treated ideas as factors which cause ideas. Rather I have analyzed the social setting of experts for its influence on the structure of debate.

I have also shifted the internal versus external influence issue by considering the statements by experts as argumentative behaviour and not as more or less correct indicators of the private thinking of experts (see section 4 above). In this way, the problem of how particular scientists have actually formed their opinions is replaced by the problem of how the social setting of experts affects their arguments. The issue of the relative importance of internal versus external ideas to opinion formation becomes the issue of the relative importance of internal versus external issues in the arguments made by experts.

The findings in the thesis on internal and external issues relate, therefore, to the extent to which debate is structured for participants on certain issues, and the extent to which this varies among groups. I argue that for participants external issues were more structured than internal issues. This was indicated by the overall higher percentage of extreme external legitimizing comments than of internal/translation extreme legitimation comments (see Chapter 10). This does not mean that external ideas were more important to opinion formation. This just shows that external debating issues were more general and agreed upon. Correspondingly, internal issues were reasoned about on a more local basis relating to the particular scientific dimensions of various problem areas.

The relatively greater external structuring of the debate is not, I would think, an invariable general phenomenon. I suspect that this would vary with the social setting of expertise relating to a variety of factors including the way experts are selected, and the relative importance of interest groups versus scientific communities in structuring debate. In addition, the complexity of the scientific issues associated with a controversy may affect the extent to which scientific issues can structure debate. In the example I have chosen for study the problem was sketched very broadly across a range of scientific disciplines. The impact of pipeline development in relation to biology resulted in testimony on birds, fish, mammals, and plants. A more narrowly focussed public issue such as the possible effects of fluoride in drinking water could perhaps be more easily structured in terms of scientific issues. I would suspect, however, that the extent to which scientific debating points are narrowly focussed or cover a broad range of topics is not something which is given in the nature of the problem. Scientific debating points are developed and negotiated within various social contexts. This negotiation of the importance of scientific expertise to debating issues is, I would like to suggest, of fundamental importance to a more complete understanding of expertise.

The variations among groups on internal/external debating issues also reflects the social organization and experience of these groups. Arctic Gas scientists with their high involvement had the highest percentage of extreme legitimizing remarks of all groups on both sets of issues, with 89% overall. In contrast, the critical organizations' experts had a total of 66% extreme legitimizing remarks (see Chapter 10).

In the case of CARC this was further broken down with a 79% extreme external legitimizing comments (the second highest) and a 33% extreme internal/translation legitimizing comments (the lowest). This reflects the lack of importance for CARC participants in justifying a cohesive set of internal issues. In contrast, the other two critical organizations' experts, COPE and the Commission, have a reverse trend. This indicates that when experts were selected for a short involvement testimony, as were the majority of these witnesses, they were selected for their ideal legitimating scientific views. CARC scientists were different in that they tended to also be more organizationally involved and were not, therefore, selected primarily for their scientific statements. These findings on the importance of interest group factors for structuring debate is a form of "external" argument on a social level. I am arguing that a crucial factor which structures debate among experts is not the scientific community but organizational or interest group affiliations(see chapters 3 and 9).

In summary, I have tried to demonstrate that expert arguments vary with social factors and that this extends to the relative prominence of internal and external factors. I have based this analysis on a view of argument as interpretive action which, because of its flexibility, allows the social context of experts to structure expert arguments. In this analysis I have shifted the focus of study from the traditional "ideal" question of how have external factors influenced scientific reasoning, to the question of how has the social situation of experts affected the structure of their arguments.

6. Toward an Interpretive Political Sociology of Expertise:

Throughout this thesis I have referred to my adoption of an interpretive sociological perspective. There are two major interrelated ways in which this term has meaning. The first comes from Weber with his emphasis on the interpretive understanding of the subjective dimensions of action (Weber 1947 p. 104). The second relates to a distinction between normative and interpretive sociologies, drawn repeatedly within both sociology as a whole (Wilson 1970) and within the sociology of science in particular (Law and French 1974, Mulkay 1979). The basis for this distinction revolves around the importance of rules or norms in determining action (see Marshall 1980, Dawe 1970, Blumer 1969).

The first sense of interpretive, concentrating on the subjective dimensions of action, comes through clearly in Chapters 3, 4 and 5 on the social organization of experts and the subjective dimensions of conflict. In this thesis I do not reason directly from an "objective" analysis of structure to disputes among experts. Instead I build my investigation of the sociology of experts upon a consideration of the "subjective" things participants say about their sponsors, other organizations, and the Commission. This sociological analysis of expertise, although focussed on subjective factors, is also structural, in that I construct a sociology of expertise which emphasizes structural factors such as the differences in resources among organizations. In this way I demonstrate that it is crucial to consider these subjective factors in constructing an analysis and I show that doing this is consistent with the analysis of structure and power, essential dimensions of any political sociology.

The second sense of interpretive which I use revolves around the interpretive sociology position concerning the place of norms and values in structuring action. According to interpretive sociologists the normative position views action as rule determined, while the interpretive position emphasizes people as interpreting and negotiating rules in particular social contexts (Wilson 1970, Law and French 1974). This emphasis on the analysis of norms is evident in the interpretive critique of the Mertonian norms of science and its extension to the analysis of cognitive rules within science. What is taken to be a violation of a social norm or adherence to a given style of scientific practice is negotiated and interpreted within particular social contexts (see Chapter 1).

I have not concentrated on whether someone has actually behaved in accordance with some rule. I have focussed my analysis on verbal behaviour. I have attempted to show that argumentative behaviour is structured by social factors.

The word "structured" is important as opposed to that of constraint. Constraint implies a bending and shaping of the action of individuals by groups. But I have argued that in some cases experts may have been selected for their compatible, pre-existing ideas. Insofar as this is the case, then the argumentative action of these experts cannot be said to be constrained by these particular interest groups. What may be constrained in some cases is, however, a limited aspect of action, thus still leaving considerable scope for interpretive flexibility.

The focus on argumentative behaviour is important since I have not causally explained the thinking processes and motivations of individuals. The actual motives of individuals have been treated as incidental to the behaviour (see section 4 above). Action within a debate is structured around the making of arguments. In this way the interpretive action of participants in making arguments may still be quite complex and not derivable from the particular social context of the debate. Indeed, the interpretive perspective on the complexity of action in relation to verbal behaviour has lead me to concentrate on the observable arguments of experts.

The theoretical beginning point for this research has been two major interconnecting debates in this literature, one about experts and one about the nature of scientific action. The first debate concerns the political impact of expertise. The end of ideology position in this debate, most clearly seen in the work of Bell (1976) and Lane (1966), outlines how scientists as experts have a calming and rationalizing influence on public policy issues. In contrast, the political or public policy position on the impact of expertise, most clearly seen in the work of Gilpin (1962), Mazur (1973) and Nelkin (1975), accentuates how experts have become part of public policy controversies and do not dampen conflict (see also Blume 1974, Boffey 1975). The evidence presented in the present study, demonstrating the use of experts as a resource by interest groups, reinforces this latter position against the "end of ideology" writers. The second debate in the literature concerns the nature of science. Implicit in both the end of ideology and the public policy positions on the impact of expertise is an image of science as basically fact-finding, with judgements being made about uncertainty. In contrast, the work within the sociology of scientific communities and action has tended to portray science as fact-generating. Judgement does not only supplement and compensate for a lack of facts, but is essential to the identification of what is a fact (see Kuhn 1970, Mulkay 1979, Barnes 1974, Bloor 1976).

This sociology of science perspective is further fragmented into normative and interpretive strains (Law and French 1974). I have developed my study from within a sociology of science tradition. I have sided with an interpretive sociology of science with its concentration on interpretation and negotiation. I have attempted to extend this perspective developed, in the study of scientific communities, to the analysis of scientific expertise (see also Wynne 1982). I hope that I have shown that an interpretive political sociology of expertise is a fruitful research approach. I believe it provides an alternative basis upon which to extend the work of Nelkin (1975) and Mazur (1973) on the sociology of expertise.

III. Propositions and Recommendations for Further Research

It is important to be cautious in generalizing from the findings of a case study. The findings of this research may turn out to be particular to this case. Part of the validity of a case study is in generating what is theoretically important as part of the act of research (Glaser and Strauss 1967, pp. 1-6). This can then help to direct further research. In line with these considerations, I would like to indicate several interrelated propositions:

1. That scientific experts become part of public policy conflicts and do not displace conflict.

2. That disputes among experts are structured by interest groups.

3. That differences in the resources (in terms of time and money) of interest groups will affect the argumentative cohesiveness of the scientific expertise they present.

4. That expert debates differ from debates within scientific communities in the extent to which various sides need to defend their position. In expert debates, one party is often called on to defend while the other may simply criticize.

5. That interest groups who are forced into a defensive position, as indicated in proposition 4 above, will attempt to mount more cohesive expert arguments.

In order to test these propositions, I would like to see further studies on expert controversies. But, there are two major changes which I would like to see in any study which covers the same ground as this dissertation. The first change has to do with the analysis of the social organization of expertise. The second relates to the analysis of the logic of scientists' assessments. The nature of these changes is best revealed through a comment on the process of the present study.

This thesis research was exploratory. I ended up "generating" what was theoretically important as part of the act of research (see Glaser and Strauss 1967 pp. 1-6). This happened in the case of the lack of parallel structure in debates. I had gone into the research fully expecting to find a very polarized debate. In fact, this is what I at first "saw" in the public information. I read the transcripts and was impressed by the extreme positions of some of the debators. My interviews did not confirm this impression. I was confronted with a very complex reality in my face-to-face encounters with debators. My re-reading of the transcripts then confirmed the interviews. I then had to analyze what it was that made these groups of scientists different and it was then that the analysis of the social organization of expertise became much more important than I had originally thought. As a result, one major improvement in a subsequent study would be to broaden the analysis to pay closer attention to the social organization of experts More detail on the organizational structure and practice of the various groups would strengthen this type of analysis. This would help to clarify some of the causal chains which are operating in expert debates. For example, the extent to which interest groups rely on pre-existing expert opinion, and the extent to which this is cultivated by interest groups, could be more clearly outlined by a study with some time dimensions. In addition, a more detailed, perhaps participant observation study, of the development of expert arguments by organizations would help to identify and clarify integrative social forces.

The second area, the "logic" of scientists' assessments, again arises out of the process of the research. I had originally thought that simple association between a public policy attitude and a biological assessment implied some influence of the former on the latter. During the course of my research, however, I came to see both ideas as part of arguments concerning impact. The priorities in terms of causal influence and the "logic" of arguments, that is, the way that these various ideas are put together as part of arguments, are not always clear. For example, in the case of the "ability to build", I found that there was a strong consensus among all scientists that the pipeline could be built. But many critical scientists had concrete "ability to build" reservations which they expressed at other points in the interviews. I could not, however, deal systematically with this difference since I had not asked all participants whether they had particular technical reservations. These various levels of reasoning on the same topic and the way that these components go together in terms of how important a certain issue is to an actor's argument,are crucial to a consideration of the logic of expert arguments.

IV Practical Implications

Scientists as experts are an important part of policy questions in modern society. Their performance in public is frequent, yet the phenomenon of expertise has not been studied to any great extent. This study is an attempt to clarify aspects of the disagreements among experts.

This research may not be satisfying to some readers with particular practical interests. For example, if one is interested in a method by which it is possible to tell whom to believe in expert debates, this analysis will not be of direct value. The research may, however, assist the reader in understanding what it is that goes on when experts disagree.

There are, however, three aspects of the present study which I would like to emphasize for their practical implications. These are: first. the analysis of the components of impact assessments; second, the social nature of science and expertise; and third, the importance of differences in power for the nature of expertise.

The first point arises from my analysis of the various components of participants' attitudes on issues related to pipeline development. I showed that scientific questions could not be isolated from a variety of external issues in reasoning about impact. This finding demonstrates the importance of the consideration of a variety of scientific and non-scientific factors in public policy issues involving expertise.

Second, the research outlines the importance of the social nature of science and expertise. Science and expertise are, like any other feature of the affairs of people, social in nature. This would tend to undermine claims for some type of ahistorical objectivity present in expert debates.

Third, the element of power and the differences in resources of contending parties has clear implications for the nature of expertise. Even a fairly cursory examination of most controversial issues involving science and technology reveals an imbalance in the production of knowledge among parties. This study demonstrates, however, that not only do parties vary with respect to the amount of knowledge they possess to argue a case, but they also vary in the extent to which they are able to integrate scientists within their cause. In other words, the nature of expertise itself varies because of the unequal resources of interest groups. Powerful, usually private, interests can make strong cases not only because they control information, but also because they can present a cohesive group of experts. Opposition expertise tends to be fragmented in addition to lacking in the command over information.

In short, expertise presents problems which are fundamentally no different than in any other area of public affairs. Issues are characterized by complexities and permeated by social and power dimensions. Effective practical action must be based on this realization.

FOOTNOTES

1 Present work by Mulkay and Gilbert argues along similar lines (Mulkay 1980; Mulkay and Gilbert 1981a, 1981b; Gilbert and Mulkay 1981).

APPENDIX I

LIST OF INTERVIEW QUESTIONS USED IN THE STUDY

1. "What do you think of (affiliated organization)'s impact assessment and input into the Inquiry?"

2. "What do you think of (organization)'s impact assessment and input into the Inquiry?"

3. "What do you think of the whole idea of a Mackenzie Valley Pipeline? Is it a good or bad thing for the north? Is it necessary?"

4. "Could it (the pipeline) be built?"

5. "Do you think that industry would conduct itself in an environmentally responsible manner if the question of when and in what way a pipeline should be built were left up to industry to decide?"

6. "Do you agree with Justice Berger's reliance on the corridor concept in his assessment of impact?"

7. "Is the northern environment fragile?"

8. "How would you assess the adequacy of the knowledge base for the prediction of impact?"

9. "Where uncertainty exists in the knowledge base, how do you think an impact assessment should be resolved? Would you tend toward caution and decide against proceeding with a project, or would you tend toward confidence and decide in favour of the execution of a project?"

10. "What do you think of Berger's impact statement?"

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APPENDIX II

LETTER TO INQUIRY PARTICIPANTS

Dear (Participant),

I am a Ph. D. candidate in the Department of Sociology at McMaster University. My doctoral research is on the evaluation of the information provided by witnesses in the living environment phases of the Berger Inquiry. Through interviews with participants and the Inquiry transcripts, I am examining the way in which expert opinion was sifted and assessed. The Berger Inquiry has been chosen for study since it has become a model for public participation in impact assessments at a time when this type of hearing is increasingly commonplace. My research is aimed at an increased understanding of the ways questions of public concern, with large technical and scientific components, are debated and resolved. The goal of this understanding is an improvement of this process.

I would like to interview you about your experiences with the Berger Inquiry. In line with standard social scientific practice, our conversation would be treated with the strictest confidentiality. Our discussion would take an hour or two of your time.

I have a B. A. in sociology from the University of Guelph and a B. Phil. in sociology from the University of York in England. For the last four years I have been studying social aspects of science and technology. The present work is funded by the Social Sciences and Humanities Research Council (formerly part of the Canada Council), and through McMaster University's Presidential Committee on Northern Studies, the Department of Indian and Northern Affairs.

If interview arrangements can be suitably made, I plan to travel west in late September or October. If you agree to meet with me, please indicate if this time of year is convenient for you. If possible, I would appreciate if you could communicate any particular dates which stand out as good or bad meeting times. I will get back to you with more precise dates after I have received enough replies to my letters.

I hope that you will consent to sharing your views and experiences with me.

Yours sincerely,

Brian Campbell

APPENDIX III

THE STRUCTURE AND USE OF TABLES

The interview data is presented in a series of tables. There are three major divisions in the table style. One type of table includes the responses of lay and scientific participants together, grouped by organization. This is done in the chapters of the narrative which deal with the subjective dimensions of conflict among organizations. In this type of table only absolute numbers are given since the populations are too small for any statistical treatment. A second type of table summarizes only the responses of scientists, again using only absolute numbers because of small populations. This is by far the most common form of table. All of the debating points are discussed individually using these tables.

In addition, the chapter on the social organization of scientists, where I analyze scientists' assessments of their sponsors, uses this form of table. Finally, at the end of analysis I construct tables which summarize all of the debating points covered in the study. The sufficient number of responses overall makes it possible to present the data in the form of percentages. These summary tables deal only with scientists' responses.

The populations are small, so numbers cannot be used as the major focus of argument. The numbers in the tables are not, therefore, the cornerstone of the analysis. In the narrative, I quote extensively from the open-ended interviews to justify my reading of events. This extensive quotation is crucial for the validity of this study, since operational definitions were not used to classify responses. The inclusion of extensive quotes helps to justify the classifications. It also provides a visible data base to allow another analyst to make an alternate interpretation.

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